



**NEEDING A LIFT
WHY BOEING HAS
BIGGER WORRIES
THAN END OF C-17
REPORT P19**

NUMBERS GAME
We look beyond the sales figures to weigh up how big two fared in airliner orders battle last year **11**

BACK TO BASICS
Alarming report from US authorities reveals many pilots need to improve manual flying skills **13**

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ANALYSIS

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How 2015 was a record-breaker, and what we learned from tragedy

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**COVER IMAGE**

The crash of TransAsia Airways flight 235 was the worst single loss included in our annual safety review for 2015: 43 people died in the ATR 72-600 **P22**

**BEHIND THE HEADLINES**

Our expert reporting team of **Murdo Morrison** (left) and **David Kaminski-Morrow** were in Paris, as **Airbus** released a bumper set of results for its **commercial aircraft** unit. We look at the company's **key programmes**, and ambitions for the year ahead (**P7**)

**NEXT WEEK SUPERSONICS**

Forty years after we hitched a ride on Concorde's inaugural flight, could supersonic travel be set for a near-term revival?

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Ecojet developers peruse list of production sites **P15**

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22 Aviation safety 2015 – the facts While aviation disasters will always loom large in the public's imagination, the truth is that last year continued a trend towards fewer and fewer accidents and greater passenger safety. Our safety analysis of the events of last year includes a comprehensive listing of known significant incidents compiled in association with Flightglobal's advisory service Ascend

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FAA to "dissect" passenger jet to study cyber security **P12**. Saudi Arabia orders anti-submarine Seahawks **P17**



Airteamimages, US Navy



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IMAGE OF THE WEEK

KLM's regional Cityhopper operation is firming options on a pair of Embraer 175s. The Brazilian airframer says the agreement follows a previous 17-unit order for the type, plus up to 17 more. Featuring a single-class layout, deliveries of the new twinjets will start in March, says the Dutch carrier

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Embraer

THE WEEK IN NUMBERS

↑ **8-9%**

Alcoa

Alcoa forecasts strong 2016 global aerospace aluminium sales growth on "robust demand" for commercial aircraft

\$108m

Flightglobal dashboard

Cost to Japan's All Nippon Airways of an 8.8% stake in Vietnam Airlines; the pair hope to grow regional air traffic

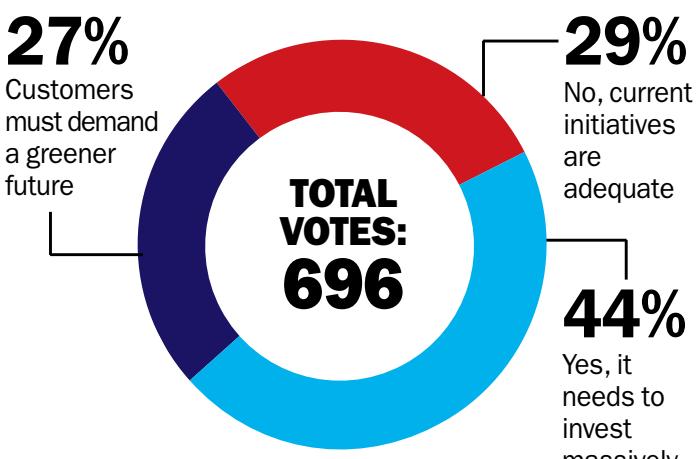
↑ **500**

Flightglobal dashboard

Number of aircraft held by Bohai Leasing, after the Hong Kong Aviation Capital parent's \$7.6bn acquisition of Avolon

QUESTION OF THE WEEK

Last week, we asked: **Should aviation do more to reduce its environmental impact?** You said:



This week, we ask: **When will Airbus or Boeing first deliver 1,000 aircraft in a year?**

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Chain reaction

Could supplier glitches prove a bigger headache for aircraft manufacturers than the worry of demand falling away as they prepare to accelerate production towards the end of the decade?

There are jitters on the Chinese stock market and worries about many emerging economies, but John Leahy has a view on the orders bubble: there simply isn't one. At the Airbus annual press conference in Paris on 12 January, the airframer's top salesman again dismissed suggestions that the industry is ramping up output just when unprecedented demand is about to topple over the precipice.

Assuming the appetite for air travel slackens, Leahy contends, Toulouse is sitting on a backlog of almost 6,800 and simply needs to go on taking one order for every aircraft it builds to maintain its production plans into the next decade – in 2015 that ratio was 1.6.

However, even if the ever-upbeat sales supremo is right about the strength of the marketplace, Airbus – and its rival Boeing – could yet come unstuck at the other end of the equation. To meet their ambitious ramp-up plans, both airframers depend not only on a growing world economy, but on global supply chains delivering highly-engineered components and subsystems to increasingly just-in-time schedules.

Too much demand is better than too little, but for suppliers could prove no less stressful

Airbus's experience with the A350 last year proves just how vulnerable the airframers are to a weak link in that chain. The new widebody was certificated almost exactly when Toulouse promised it would be – a remarkable achievement considering the shambles of the A380 programme less than a decade earlier. But the first year of production proved trickier. Leahy's boss Fabrice Brégier was unusually candid in naming and



UI/REX Shutterstock

We'll be keeping an eye on you

shaming interiors provider Zodiac at the press conference, pinning the blame on the French company for Airbus falling one short of its target of 15 A350 deliveries last year. He accused Zodiac management of being "in denial" about the supply problems and said Airbus had deselected the company from its A330neo programme.

Harsh words indeed, and doubtless enough to spark a culture change at Airbus's hapless supplier. And, while missing an annual delivery target by one aircraft hardly amounts to a crisis, Brégier promised a new "watchtower" approach to any impending slippages. Suppliers the world over – particularly on the A320neo and Boeing 737 Max, which face the steepest ramp-ups – may now well be looking at their processes ahead of what will be an extremely challenging period.

Too much demand might be a nicer problem than too little. But for the airframers and their supply chains, making good their promises over the next five to 10 years could prove no less stressful. ■

See Air Transport P7, News Focus P11

Under pressure

While their colleagues in the commercial sector face the challenge of ensuring that production rates can keep pace with record-breaking demand, the folks at Boeing Defense & Space must be wishing for a similar set of problems.

Instead, the military unit has a worse headache: how to ensure the survival of its remaining activities. After a manufacturing run for the US Air Force and a host of international customers, its final C-17 transport left Long Beach, California late last year, marking an end to more than 70 years of activity at the historic site.

Teamed with Lockheed Martin, Boeing had expected to secure the USAF's long-range strike bomber deal late last year. Now it must hope the Government Account-

ability Office can find fault with Northrop Grumman's selection if it is to benefit from the \$80 billion project.

But worse things could happen. Failure to win more orders for its aged F-15 and younger F/A-18E/F Super Hornet would make it harder for Boeing to pursue "sixth-generation" fighter opportunities with the USAF and US Navy, where it lags behind F-35 manufacturer Lockheed. And defeat in the USAF's lucrative T-X trainer competition could see it exit that market altogether.

Not buying a Boeing tanker was a step too far for the US Department of Defense – but to sustain its other military segments the company will have to unveil winning designs if it is to continue its 100-year heritage in style. ■

See News Analysis P19



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BRIEFING

PRICE RISE PUSHES A380 ABOVE \$430 MILLION

AIRLINERS Airbus has hiked the catalogue prices of its aircraft range by an average of 1.1%; a rise which takes the A380 above \$430 million. The changes, which vary little between individual types, mean that the list price of an A350-900 reaches \$308 million, while the -1000's increases to nearly \$356 million. Its A330-900neo will cost almost \$288 million, while the basic price of the A320neo climbs slightly – to just over \$107 million.

FIRST F-35 ADIR DRAWS NEAR FOR ISRAEL

PRODUCTION Lockheed Martin has begun the final assembly of Israel's first F-35 Lightning II, with lead example AS-1 having entered the mate process at its Fort Worth site in Texas on 7 January. Dubbed the "Adir" by the Israeli air force, the conventional take-off and landing aircraft is scheduled to roll out of the factory in June, and to be delivered later this year. Israel has so far ordered 33 F-35As, and expects the type to achieve initial operational capability in 2017.

DAMAGED RECORDERS HAMPER CRJ CRASH PROBE

INCIDENT Swedish investigators probing the fatal 8 January crash of a West Atlantic Bombardier CRJ200 freighter (SE-DUX) must contend with damaged flight-data recorders. The cockpit-voice and flight-data recorders have been retrieved, but both units sustained heavy damage, says Swedish investigation body SHK. The aircraft, with two crew members on board, came down west of lake Akkajaure in the far north of Sweden. It had been operating an Oslo-Tromsø postal flight when radar contact was lost around midnight on 8 January, about the same time as its crew transmitted an emergency call.

FRENCH ARMY TO BOOST NH90 FLEET

ROTORCRAFT France has ordered an additional six NH Industries (NHI) NH90 tactical transport helicopters for its army – for delivery between 2017 and 2019, in a move which will increase the service's eventual inventory of the type to 74. Guillaume Faury, chief executive of lead NHI shareholder Airbus Helicopters, points to the 11t-class rotorcraft's "outstanding endurance, versatility and manoeuvrability" during French operations in Mali.

MOSCOW MAKES INDONESIA OVERTURE ON MC-21

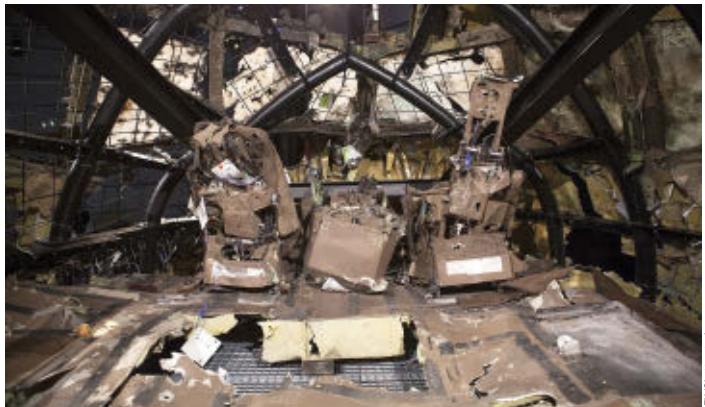
MANUFACTURING Russia's government is considering sourcing some components for the Irkut MC-21 twinjet from Indonesia, as an alternative to using Western suppliers. Such co-operation would be mutually beneficial and help the new type to penetrate the local market, Russian industry and trade minister Denis Manturov said during a visit to Jakarta.

MORE WARRIOR HEADING FOR KABUL

ORDER Afghanistan is to receive another 12 MD530F Cayuse Warrior armed scouts, with MD Helicopters to deliver the aircraft within the next 12 months. Ordered via the US Army and to be flown carrying pods for .50 cal guns and 2.75in rockets, the rotorcraft will join 16 Cayuse Warriors already in use with the Afghan air force.

TBM 900 SPURS SALES REVIVAL FOR DAHER

DELIVERIES Daher recorded a 10% rise in deliveries of its TBM 900 turboprop in 2015. The French airframer shipped 55 of the single-engined type – the third iteration of the TBM series – last year, against 50 in 2014. This is the highest annual shipment tally for the 20-year-old TBM series since 2008, when it delivered 60 TBM 850s.



REX/Shutterstock

Official report said flight MH17 was shot down by a Buk missile

INQUIRY DAVID KAMINSKI-MORROW LONDON

Russia objects to MH17 conclusions

Nation's air transport authority highlights discrepancies and contradictions in Dutch investigation into fatal 777 incident

Russian authorities have formally communicated to Dutch investigators concerns that the inquiry into the loss of Malaysia Airlines flight MH17 contains several contradictions and discrepancies.

The Dutch Safety Board concluded that the Boeing 777-200ER was shot down by a Russian-built Buk surface-to-air missile over eastern Ukraine on 17 July 2014.

But Russian federal air transport authority Rosaviatsia's deputy director, Oleg Storchevoy, has sent a 12-page document to the inquiry claiming that additional analysis, by Russian specialists, indicates that a number of conclusions in the final report are "unsubstantiated and inaccurate".

This additional work has included a full-scale static experiment in which an Ilyushin Il-86 cockpit was destroyed by a 9M38-series missile, of the type installed on Buk launchers.

The document claims that, "even assuming the aircraft was brought down by a Buk", the description of fragments in the inquiry report "does not match" that of pre-formed fragments in a 9N314M warhead – the type used against MH17, according to the Dutch Safety Board.

It adds that the inquiry's description of the penetration dam-

age in the wreckage is inconsistent with that caused by such a warhead and that the fragment spray does not match the identified detonation position.

At least one missile fragment located at the crash site does not match the appearance of encasing fragments from a 9M38-series surface-to-air weapon, it claims, and the proximity fuse algorithm of the missile does "not agree" with the engagement conditions.

CONCLUSIONS

It shrugs off conclusions based on matching paint samples and explosives traces, as well as those about the area from which the missile was launched.

The document also claims there is "no evidence" that two Ukrainian military aircraft – an Antonov An-26 and Sukhoi Su-25 – were downed by heavy air-defence systems in the same month.

It insists that the final report "unfairly obscures the issue of liability" by "shifting the blame" from Ukrainian authorities to airlines and ICAO. The Ukrainian authorities did not issue any notice which would have "unambiguously" indicated a threat to civil aviation, it says, adding that they "should have closed" the air-space over the conflict zone as early as April 2014. ■



SUPPLY CHAIN DAVID KAMINSKI-MORROW PARIS

Zodiac's star wanes at 'patient' Airbus

Troubled seating supplier singled out for criticism by Brégier as airframer narrowly misses 2015 delivery target for A350

Airbus has blamed cabin interior problems for narrowly missing its A350 delivery target for 2015, singling out seat supplier Zodiac for particular criticism.

The airframer delivered 14 of the Rolls-Royce Trent XWB-powered widebodies last year, one aircraft short of its plan, with the final shipment on 31 December a third A350 for Finnair.

Airbus aims to double, at least, total A350 production this year, and plans to achieve a monthly rate of 10 aircraft in 2018.

"The problems at Zodiac are not yet fixed but the company has clear action plans and can recover"

FABRICE BRÉGIER

Chief executive, Airbus

Chief executive Fabrice Brégier, speaking during the company's annual results briefing in Paris on 12 January, said the manufacturer had been "trapped" by "some cabin elements" which prevented it from reaching the original target.

Seat supplier Zodiac has been a particular bottleneck for the pro-

gramme. Brégier says the airframer has been "extremely patient" with the French company. However, he insists that Zodiac's management team, for considerable time, has been "in denial" about its supply problems, which amounts to a "recipe for failure".

Airbus has de-selected the company from its A330neo programme but Brégier says there are no plans to switch seat supplier for the A350.

He says the problems at Zodiac are "not yet fixed" but adds that the company has "clear action plans" and that it can recover. Zodiac has previously acknowledged that poor operational management led to production problems and late deliveries.

Airbus secured orders for another two A350s in December, taking its gross order total for the type to 16 last year. Cancellations, however, meant net orders for the A350 slipped by three to 777.

Airbus expects to deliver "at least" 50 A350s in 2016, says Brégier, but warns that meeting the target will not be "a walk in the park".

He says the first A350-1000 will enter final assembly in February and that the company aims to achieve first flight for the variant by the end of this year. ■



ArneBainbridge

Finnair received its third example of the widebody twinjet last December

PROGRAMME

Neo engine issue still requires 'tweaks'

The first A320neo will be delivered by the end of January, Airbus says, after the airframer missed an end-December 2015 deadline to hand over the initial example to Lufthansa.

The German carrier became a late replacement as launch customer for the type after Qatar Airways last month postponed taking receipt of the first aircraft for undisclosed reasons.

Although the aircraft had achieved certification, chief executive Fabrice Brégier says Airbus had nevertheless been left with "a lot to do" before the Pratt & Whitney PW1100G-powered aircraft could be transferred to the customer.

Speaking during a Paris briefing,

Brégier said the airframer had to give "enough confidence" that maintenance processes – notably for the new engine – were ready, and that the small available fleet could provide sufficient training to pilots.

Airbus chief operating officer Tom Williams says the airframer is working to overcome a rotor bow issue during start-up of the P&W engine – a phenomenon in which temperature variations in the turbine along its shaft affect the alignment.

Airbus is working on "small tweaks", he says, including transferring more of the process to the full authority digital engine control, and expects to have overcome the issue by around February. ■

ANALYSIS

Boeing in it for long-haul as rival wins orders battle

Net orders for 1,036 aircraft in 2015 put Airbus comfortably above rival Boeing's total of 768 – however, the latter maintained its dominance in the long-haul market.

Airbus's net order total for the year included 139 long-haul aircraft – including two A380s – plus 897 single-aisle types. Boeing sold 180 long-haul aircraft.

Airbus exceeded – by six aircraft – its previous record output by achieving deliveries of 635 jets, including 14 A350-900s.

However, it was out-delivered by Boeing, which handed over a total of 762 aircraft, beating its rival on output of both short-

and long-haul models. A350 production, despite falling just short of target, offset a fall in A380 and A330 deliveries.



A320-family deliveries stayed largely static.

Airbus handed over 27 A380s in 2015 – a year in which it broke even at production level on the type – as well as 103 A330s and 491 single-aisle jets from its A320 family. Gross orders of 1,139 aircraft include three A380s, but Airbus is yet to disclose the customer.

The airframer's activity through the year took its overall backlog at 31 December to 6,787 aircraft, while Boeing's stood at 5,795. ■

See News Analysis P11



SAFETY DAVID KAMINSKI-MORROW LONDON

Take-off incidents face AAIB scrutiny

Budget carrier EasyJet issues briefing note to pilots in wake of departure issues due to performance calculation errors

EasyJet has underlined to crews the importance of cross-checking performance calculations after three take-off incidents in four months came under investigation by the UK Air Accidents Investigation Branch (AAIB).

Pilots of an Airbus A320 erroneously used a full-length runway calculation when conducting an intersection departure from London Luton on 16 July last year, says the AAIB.

It adds it is looking into miscalculation events involving EasyJet A319s at Belfast, on 25 June, and Lisbon, on 16 October.

Inquiries into the Luton incident found the crew had programmed a full-length departure for runway 08, but revised the plan to an intersection take-off after a waiting aircraft was held up on the threshold.

While the captain told investigators he had attempted to change runway selection, the inquiry says a combination of his finger size and the calibration of the touch-screen on the electronic flightbag probably resulted in the change not being completed.

The captain suggested he was distracted from confirming the se-



AirTeamImages

Events in Luton, Belfast and Lisbon put the spotlight on airline

lection by a decision to change the aircraft's flap setting.

The aircraft's thrust settings and speeds remained incorrect for the intersection take-off, for which only 1,690m (5,540ft) of runway was available compared with the full 2,160m. It reached V1 decision speed with 580m of runway left and the captain committed to take-off after noticing the shortening distance. Flight-data recorder information showed the A320 became airborne at 148kt

(274km/h) about 180m from the runway end.

The Belfast and Lisbon incidents involved crews calculating take-off data for an opposite-direction runway, with the Belfast departure using full-length runway data for an intersection departure.

EasyJet has added a briefing note to flight plans, says the AAIB, about cross-checking calculations after last-minute changes. It plans to publish an article in the carrier's flight safety bulletin. ■



DEVELOPMENT GREG WALDRON SINGAPORE

Legroom pitched as the driver for MRJ seat swap

Mitsubishi Aircraft has reduced the number of seats on both the MRJ90 and the MRJ70, ostensibly with the goal of increasing seat pitch, but with the added benefit of reducing the regional jet's empty weight and increasing range.

In a standard configuration, the MRJ90 will have 88 seats, down from 92, while the MRJ70 will have 76, down from 78.

Cutting the number of seats will allow the MRJ to have an "industry standard" seat pitch of 31in (79cm), up from 29in, while also reducing the weight of the larger aircraft by some 408kg (900lb), says Mitsubishi. In turn, this will allow range to increase by about 250nm (460km).

Previously the MRJ90's range

was listed as 902nm, which now grows to 1,150nm. The MRJ70 was previously identified as having a range of 825nm, now revised to 1,020nm.

The MRJ90 now matches the listed performance of its main competitor, the Embraer 175 E2, which will have a range of 1,010nm when configured with 88 seats.

In late 2015, Mitsubishi announced a year's delay to the MRJ's first delivery in order to give it time to strengthen the airframe and upgrade its software.

However, the Japanese manufacturer stresses that the seat changes do not involve alterations to the airframe. No further weight-reduction activities are planned, it says. ■

UNMANNED SYSTEMS ARIE EGOZI TEL AVIV

Germany swoops for Heron TP

Israel Aerospace Industries' (IAI) Heron TP unmanned air vehicle has been selected by Germany as the preferred system for its future requirements.

Airbus Defence & Space and IAI last year signed a teaming agreement linked to a proposed continuation of services to the German military with the new Heron variant. This would follow the Bundeswehr's use of the smaller Heron 1 in Afghanistan, performed under lease with the Airbus unit.

Berlin has been seeking a bridging solution with upgraded features to maintain its surveillance capabilities until the arrival of a joint European medium-altitude,

long-endurance UAV in around 2025. After Berlin's decision, discussions will progress on a lease deal, which its defence ministry says will be for three to five systems. Operations with the type – which could be armed with air-to-surface missiles – will be supported by a simulator at the German air force's Schleswig-Holstein air base, it adds.

Announced by defence minister Ursula von der Leyen on 12 January, the selection of the Heron was made in preference to a rival proposal using the General Atomics Aeronautical Systems MQ-9 Reaper. ■

Additional reporting by Craig Hoyle in London

MITSUBISHI REGIONAL JET SPECIFICATIONS

	MRJ70*	MRJ70 ER*	MRJ70 LR*	MRJ90**	MRJ90 ER*	MRJ90 LR**
Range (nm)	1,020	1,670	2,020	1,150	1,150	2,040
MTOW (kg)	36,850	38,995	40,200	39,600	40,995	42,800

NOTE: *76-seat single-class layout **88-seat single-class layout. SOURCE: Mitsubishi Aircraft



ENGINEERING JAMES DREW WASHINGTON DC

F-35 schedule faces extra pressure

“Low-risk potential” of fuel tank over-pressurisation latest concurrency issue to affect fifth-generation fighter programme

The issue of concurrency has again struck the Lockheed Martin F-35, after it was found air in the fighter’s fuel tanks could over-pressurise “beyond design limits” in certain flight profiles.

Described as a “low-risk potential”, the flaw was identified during lightning protection qualification in late 2014, and re-confirmed in follow-on tests last year, the Joint Programme Office (JPO) tells *Flight International*. The issue, which impacts all three F-35 variants operated by the US services and international buyers, led to “pre-cautionary flight limits” being imposed, it adds.

The concurrent development and fielding of aircraft has been a challenge for the F-35 programme since its inception, with previous discoveries having led to delays and expensive fixes or workarounds. Lockheed has delivered 154 aircraft, with a year of testing remaining.

Last December, the programme flight-tested new pressure relief valves to enable it to remove the latest flight restrictions. Modification work will begin on 41 A-model aircraft, under a \$28.8 mil-



US Air Force

New relief valves will allow F-35A flight restrictions to be removed

lion contract with Lockheed announced on 12 January. This also includes examples already delivered to Australia, Italy, the Netherlands and Norway.

US Air Force F-35 integration office director Maj Gen Jeffrey Harrigan alerted Congress in written testimony last October, saying a decision would be taken in De-

cember on whether the “major” over-pressurisation modification could wait until the next modification cycle, or require immediate action. The latter could make it difficult for the service to declare initial operational capability with the type in August at Hill AFB in Utah, as planned.

The JPO says a contract modification has been made to retrofit short take-off and vertical landing F-35Bs with relief valves, and Lockheed is compiling an engineering proposal to correct the carrier-based F-35C. F-35As will be modified using “concurrency funding” in low-rate initial production contracts. ■

PREPARATIONS

Multinational school soars past 3,000 sorties at Luke AFB

The multinational pilot training centre at Luke AFB in Arizona has grown exponentially since receiving its first Lockheed Martin F-35 in March 2014, with the unit recently having logged its 3,000th sortie.

As the world’s premier training base for the conventional take-off and landing F-35A, Luke is preparing pilots and instructors for the US Air

Force, Australia, Italy and Norway, with Israel and Japan to soon join this list. Other partners – the Netherlands, Turkey and possibly Canada and Denmark – will join the pooling arrangement and share aircraft and instructors.

56th Fighter Wing commander Brig Gen Scott Pleus says the base counts 34 pooled F-35As in USAF,

Australian and Norwegian liveries. “Throughout this year, I’ll get two more Norwegian F-35s, our first two Italian F-35s, and six more F-35s with US flags on the tail,” says Pleus. “We’ll be sitting somewhere around 44 jets by the end of 2016.”

Eventually, Luke will house 144 jets assigned to six training squadrons, and have 12 simulators. ■

DATA

Five-year high for Embraer as deliveries stay strong

Embraer ended 2015 on a five-year high, with full-year deliveries across business and commercial aviation hitting 221 aircraft. That total fell short of 2010’s 246 deliveries, but was an improvement 208 in 2014.

In all, the Brazilian airframer

handed over 101 regional jets during last year – one aircraft above its guidance – and 120 business jets, including the first examples of its superlight Legacy 450, which were handed over in the final quarter.

During the three months

ended 31 December, it shipped 33 commercial jets – the majority of which were E175s – and 45 corporate aircraft; the latter total dominated by 23 Phenom 300 light jets.

Its firm order backlog stands at \$22.5 billion, having been lifted

in the last quarter by orders for 19 more E175s from US carrier SkyWest and the firming of two options by KLM Cityhopper.

The orderbook now includes only three examples of the E170, the smallest EJet-family member, all destined for Japan Airlines. ■

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ANALYSIS MAX KINGSLEY-JONES LONDON

Boeing edges single-aisle deliveries

Lead likely to be short-lived as Airbus ramps up A320 shipments, but Seattle's overall output will stay ahead in near term

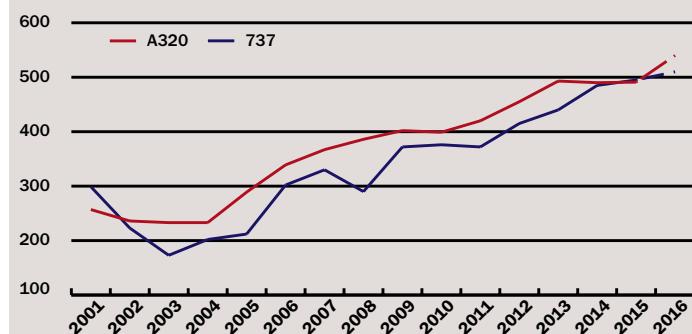
Boeing's 737 stole the single-aisle output crown from Airbus last year after a hiatus of more than a decade. But it is likely to be a briefly held lead, with the European manufacturer moving back ahead as it ramps up output this year.

The 737's overhauling of the Airbus A320 family came as the gulf in overall output between the two rivals widened in 2015. Boeing delivered 762 aircraft, a 5% rise on its 2014 tally, while Airbus's production was essentially flat – increasing from 629 units to 635. Both totals were company highs, however, with Boeing breaking the industry record of 723 deliveries it set in 2014. Their combined production increased by just over 3%, to almost 1,400 aircraft.

BOEING PLACES

While Seattle raised full-year 737 output by 10 units to 495 aircraft, production of the A320 was flat, at 491. This gave the Boeing twinjet its first production victory over the A320 since 2001 – when 299 737s were delivered, versus 257 A320s. The following year both manufacturers cut output in the

MAINLINE SINGLE-AISLE ANNUAL DELIVERIES



SOURCE: Flightglobal's Fleets Analyzer database

wake of the 9/11 terrorist attacks. While Airbus resisted pressure to slash A320 deliveries, shipping 236 aircraft, Boeing dropped the 737 rate by a quarter, to 223 aircraft.

Since 2002, Airbus has maintained a lead over its rival which grew to almost 100 units in 2008

– 386 A320s versus 290 737s – before the delta began to reduce to the point where Boeing moved in front last year.

However, Chris Seymour – head of market analysis at Flightglobal's Ascend consultancy – expects Boeing's success in 2015 to be a blip and Airbus to retake

the single-aisle crown this year. "As the A320neo enters the fray, Airbus will ramp up production faster than Boeing this year and move ahead again, to reach 50 a month by the first quarter of 2017. The 737 will reach 47 a month in 2017 as the Max enters service," says Seymour.

This year, combined output of the A320 and 737 is forecast to rise 6% to approximately 1,050 deliveries, effectively double the 2001 total. Seymour says by 2020, the manufacturers will be building over 1,300 single-aisles a year, with Airbus output at 60 units a month and Boeing at 52.

NEO ARRIVAL

Airbus chief executive Fabrice Brégier says A320neo production ramp-up will emerge largely in the second half. Airbus is aiming to transition to an all-A320neo output, while putting in place its plan to raise monthly production to 60 in mid-2019.

Overall, Boeing's share of mainline jet deliveries increased to almost 55% last year, from 53% in 2014. This marks the fourth successive year the Seattle manufacturer has out-produced Airbus, a trend that looks set to continue.

Brégier says with A320 rates rising and at least 50 A350s planned for delivery in 2016, the airframer's output will increase slightly again this year, to a record 650 shipments. Boeing is expected to provide its 2016 delivery

guidance later this month. "Boeing's ongoing lead reflects the strength of its widebody output with 233 777s and 787s delivered in 2015, compared with just 117 A330s and A350s," says Seymour. "The A350 will see a significant increase in production during 2016, but won't reach its full 10-a-month rate until 2018."

Seymour envisages Boeing maintaining its output advantage for at least two years, but highlights speculation the 777 rate may need to be cut by 2017 as the manufacturer bridges production to the 777X.

"Even with the A330 rate coming down, the gap between the two OEMs is expected to narrow," he says.

"As the A320neo enters the fray, Airbus will ramp up production faster than Boeing"

CHRIS SEYMOUR

Head of market analysis, Ascend

From an orders perspective, Airbus and Boeing's combined tally declined more than a third last year from the all-time commercial jet record of 2,888 net orders in 2014, to 1,804 net sales. While respectable, it is the first time combined net orders have dropped below 2,000 since 2010.

Airbus was top seller for a third consecutive year, securing 1,036 net orders, compared with its rival's 768. The success of its A320 powered much of Airbus's advantage, with net sales for all variants reaching 897 last year, compared with 588 737NG/Max aircraft.

With Boeing achieving a book-to-bill ratio of one and Airbus 1.6, the combined order backlog grew during 2015 by over 3%, to almost 12,600 aircraft. This represents around seven years of production at currently planned rates. ■

JET AIRLINER DELIVERIES, ORDERS AND BACKLOG

Airbus	2015			2014		
	Deliveries	Net orders	Backlog*	Deliveries	Net orders	Backlog*
A320ceo	491	47	1,064	490	310	
A320neo	0	850	4,471	0	1,011	
A330ceo	103	90	180	108	34	
A330neo	0	50	170	0	120	
A350	14	-3	762	1	-32	
A380	27	2	140	30	13	
Total	635	1,036	6,787	629	1,456	
Boeing						
737NG	495	179	1,320	485	204	
737 Max	0	409	3,072	0	900	
747	18	2	20	19	0	
767	16	49	80	6	4	
777	98	38	218	99	63	
777X	0	20	306	0	220	
787	135	71	779	114	41	
Total	762	768	5,795	723	1,432	
Grand total	1,397	1,804	12,582	1,352	2,888	

NOTES: *At 31 Dec 2015. Data includes corporate and military versions. SOURCE: Manufacturers



SAFETY MAVIS TOH SINGAPORE

Instructor faulted for poor airmanship

Belly landing of Daily Air Dornier turboprop in 2014 attributed to failings of tutor, whose actions impaired training captain

Taiwan's Aviation Safety Council (ASC) has concluded that a flight instructor who showed "insufficient" levels of airmanship and proficiency was the main cause of a belly landing involving a Daily Air Dornier Do 228 twin-turboprop in late 2014.

Registered B-55565, the aircraft took off from Taitung airport for a training mission at nearby Green Island on 21 December 2014.

The ASC found the instructor pilot and the training captain

failed to follow procedures and did not conduct a pre-landing checklist. This resulted in the crew neglecting to lower the landing gear, causing the turboprop to land on its belly.

The tutor also overloaded the training captain with instructions, impairing situational awareness in the cockpit. He subsequently failed to take control of the aircraft after the landing gear warning went off, says the ASC.

"His airmanship and the profi-

ciency was considered insufficient," it adds.

Investigators found the instructor failed to follow the mandated training programme, further degrading flight safety.

The ASC also determined Daily Air did not provide adequate training for instructors and lacked proper supervision of its flight operations.

Crews on the Dornier fleet regularly ignored the carrier's standard procedures in daily operations,

while parts of its operations manuals were inconsistent with practical conditions.

Daily Air must develop and conduct appropriate recruitment and training programmes for its flightcrew, as well as enhancing the selection and assessment of instructors, recommends the ASC.

Flightglobal's Fleets Analyzer database records that the 1996-built aircraft, owned by Daily Air, remains out of service following the accident. ■



US officials are concerned about the danger posed by hackers

RESEARCH JON HEMMERDINGER WASHINGTON DC

Nose-to-tail examination for cyber security threats

Researchers from the US Federal Aviation Administration and the Department of Defense (DoD) plan to "dissect" a passenger aircraft as part of a study into cyber security threats to aviation. Susan Cabler, assistant manager of the FAA's design, manufacturing and airworthiness division, says the DoD is leading the effort at the request of the National Security Council.

Cabler says the project is expected to last 18 months. Officials are looking to acquire the right aircraft for the study, she says, but provides no details other than it needs to be a "commercial

passenger aircraft". Her comments came during an aviation cyber security forum sponsored by the Air Traffic Control Association near Washington DC on 12 January.

Cabler, who sits on the FAA's cyber security steering committee, says investigators will "go over the aircraft from nose to tail to see if there are cyber vulnerabilities not yet identified".

Security concerns surfaced last year, after a hacker claimed he had been able to access and manipulate critical avionics systems during a flight, allegedly through the aircraft's entertainment equipment. ■

SALES DAVID KAMINSKI-MORROW PARIS

AirAsia X switches to A330neo

Long-haul low-cost operator AirAsia X has cancelled 11 Airbus A330-300s in favour of taking 11 re-engined A330neo jets.

Airbus has revealed the agreement in its full-year order and delivery data for 2015, released during a briefing in Paris on 12 January.

AirAsia X is taking the A330-900neo version of the new long-haul jet. The change raises its A330-900neo orders from 55 to 66, and effectively wipes out the carrier's A330-300 order backlog.

Airbus has secured accumulated orders for 160 A330-900neos, with the smaller -800neo accounting for another 10.

South African Airways also firmed its order for five A330-300s. The agreements, recorded in December, took overall A330 orders for 2015 to 140.

Airbus had been facing an

orders slump for the A330, which spurred it to reduce monthly production to six aircraft ahead of its transition to the A330neo.

But chief operating officer for customers John Leahy, speaking during the Paris event, claimed the airframer was now "production-constrained" on the type and indicated there was room to raise the rate to seven or even eight.

Meanwhile, Latin American operation LATAM Airlines Group has converted another six A350-900s to the larger -1000 variant, according to Airbus's full-year order and delivery figures.

The company had originally ordered 27 A350-900s but swapped six of these for the A350-1000 in October 2015.

LATAM is still taking 15 A350-900s – its Brazilian division, TAM, received the first of these in late 2015. ■



Malaysian carrier has increased its -900neo commitment to 66



STANDARDS JON HEMMERDINGER WASHINGTON DC

Pilots lack manual flying skills: report

US Department of Transportation says an over-reliance on automation is degrading airmanship and affecting safety

Commercial pilots need to gain more manual stick-and-rudder flying experience to be able to cope if automated systems fail, according to the US Department of Transportation (DoT).

A report from the agency's inspector general says a number of recent crashes highlight the need for improvements in airmanship. Cockpit automation means pilots have fewer opportunities to hone stick-and-rudder skills, it says.

The report, released on 7 January, calls on the US Federal Aviation Administration to develop standards to determine if pilots receive sufficient training for manual flying and to ensure they have adequate instruction in monitoring the cockpit – including other crew members, the aircraft's flight path and automated systems.

"Relying too heavily on automation... may hinder a pilot's ability to manually fly the aircraft dur-

ing unexpected events," says the report, written in response to a request from lawmakers on the House Transportation and Infrastructure Committee.

"Opportunities air carrier pilots have during live operations to maintain proficiency in manual flight are limited and are likely to diminish," it adds.

The report and accompanying documents cite the crash of an Asiana Airlines Boeing 777-200ER in San Francisco in July 2013, the loss of a UPS-operated Airbus A300-600F that came down near Birmingham, Alabama in August 2013, and a fatal accident involving a Colgan Air Bombardier Q400 near Buffalo, New York in 2009.

Investigators found poor monitoring by pilots, over-reliance on automation and trouble transitioning to manual flying contributed to those accidents.



Crash of Asiana Airlines 777 was cited as example of poor piloting

According to the DoT report, the FAA does not adequately oversee training of such skills, nor is it able to determine how often pilots actually fly manually.

Studies show pilots frequently overestimate their manual flying skills and would benefit from more stick-and-rudder time, the report adds.

Though the FAA issued a 2013 safety alert encouraging airlines to promote manual flying opportunities, the agency has not determined if airlines took the advice.

In a two-page letter to the inspector general, the FAA says by February 2017 it will provide

guidance airlines that can use to develop cockpit monitoring training for pilots. The FAA points that new training rules, which come into force in December 2018, will address some concerns about poor manual flying skills.

Those rules require carriers to train pilots to respond to stalls, upset prevention and recovery, manual approaches and departures, slow-speed handling, loss of airspeed indicators and bouncing at landing. The DoT, however, says the FAA has still not indicated how it intends to ensure pilots have more opportunity to practice manual flying. ■

FLEET JON HEMMERDINGER WASHINGTON DC

Refurbished 767s boost WestJet's big ambitions

After weeks of delay, WestJet on 10 January began operating company-owned Boeing 767-300ERs on revenue flights between Canada and Hawaii, with the first service linking Edmonton to Maui.

The transpacific flight marks a milestone for WestJet, which had been unable to get its 262-seat 767-300ERs certificated for extended twin-engine operations (ETOPS) in time to meet the 11 December launch date for its new Hawaii flights.

As a result, the carrier had been operating the routes since that date with 767s chartered from Omni Air International.

WestJet is bolstering its fleet with four Boeing-owned 767s that were previously flown by Qantas,

but delivery of the first two aircraft was delayed due to problems at a maintenance facility in Louisiana, plus missing paperwork.

The first aircraft (C-FOGJ) joined WestJet's fleet on 27

August, but did not enter service until 22 October, and then only operated the overland Calgary-Toronto route. WestJet received the second of the four aircraft (C-GOGN) on 20 November, with the

remainder due to arrive in the coming months.

The carrier is refitting the interiors of the twinjets, which are configured with 24 premium seats and 238 in economy. Passengers in the former cabin will be able to use WestJet Connect, the airline's new in-flight entertainment and wireless connectivity system, while economy-class customers will be provided with tablet PCs pre-loaded with movies and popular television shows. In addition, the 767s gain new winglets from Aviation Partners Boeing.

The carrier also plans to deploy 767s on routes from five Canadian cities to the UK's London Gatwick airport, beginning in May. ■

Additional reporting by Andy Cline in Toronto



Former Qantas twinjets have gained new interiors and winglets



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AIR TRANSPORT

REGULATION DAVID KAMINSKI-MORROW LONDON

Safety audit rules rile Kazakh carrier

Budget airline Bek Air may start legal action to counter new national regulations mandating IATA oversight for its airlines

Kazakh low-fare carrier Bek Air is protesting a government regulation, which came into effect on 1 January, requiring airlines to have passed an IATA operational safety audit (IOSA).

Bek Air wants the rule declared illegal and has sought an opinion from the country's prosecutor general. It says the regulation will involve "wasteful spending" of more than \$1.5 million which will affect fares – pointing out, as a private company, it does not receive subsidies.

It says the audit requirement will transfer responsibility from the Kazakh Civil Aviation Com-

mittee (CAC) and make the country's airlines "dependent" on foreign specialists – a situation it describes as "unacceptable".

Bek Air, which primarily operates seven Fokker 100s on domestic routes, says it "does not understand" the committee's intentions, claiming the carrier has demonstrated high safety levels over five years. It also stresses several operators have suffered accidents despite passing the IATA audit.

The airline has enlisted Kazakhstan's national chamber of entrepreneurs, Atameken, which states it has scheduled a meeting between interested parties – in-



AirTeamimages

Low-cost operator believes the requirement will drive up fares

cluding the CAC and IATA – for 12 January. Atameken says it was informed by the country's transport prosecutor in mid-December that the state's position on establishing international standards for civil aviation, even for domestic services, does not contradict national law. But it says the planned meeting is necessary because Kazakh airlines "do not have a unified position".

Bek Air says, while an IOSA

certificate is needed for IATA membership, such status is voluntary. Forcing an IOSA obligation on airlines, it says, will increase the cost of fares.

Kazakh carriers Air Astana and SCAT have obtained the IOSA certificate and new operator Qazaq Air has been granted a grace period. The CAC says it has no plans to restrict flights of carriers which have yet to obtain IOSA certification. ■

MANUFACTURING TOM ZAITSEV MOSCOW

Frigate Ecojet developers shortlist production sites

Developers of the Frigate Ecojet widebody airliner will in February disclose a site for assembly of the initial test prototype.

The team, working under the umbrella of the Rosavia consortium, has now finished testing a mock-up of the aircraft's elliptical fuselage in Germany. This has enabled developers to refine the design of the four fuselage sections and validate aerostructure strength and endurance parameters, says the project's deputy chief Alexander Klimov.

He adds: "To expedite regulatory approval process, we've decided to relocate and build the prototype in a Europe-

an country with certification standards set by the [European Aviation Safety Agency]. We'll identify it in February."

Working with German manufacturer ThyssenKrupp, the start-up has worked out a blueprint for a Frigate Ecojet

production plant. An independent consultancy has helped the consortium determine some 140 potential sites for the facility.

"Following analysis of various financial aspects and logistics schemes, we've tentatively shortlisted sites in Germany, the Czech Republic and Slovakia," says Klimov. "The plant will initially have capacity to produce up to 15 aircraft, with a view to ramping up the output to 45 aircraft per year."

If the project proceeds as planned, Klimov expects a first Frigate Ecojet prototype to be built in 2018 and flight trials to begin in 2019. ■



Flight trials of the highly elliptical widebody could begin in 2019

Rosavia



Flight to the future: our forecast for long-haul air travel in the 2030s
www.flightglobal.com/vision2035

**UPGRADE****Helibras delivers improved Pantera**

The Brazilian army has received its first Airbus Helicopters AS565 to have been upgraded to the enhanced K2 standard entirely at the Itajuba site of the manufacturer's Helibras subsidiary. First flight of the modernised Pantera took place in October 2015, with improvements including uprated Turbomeca Arriel 2C2 engines, a new glass cockpit, four-axis autopilot, modified engine fairings and an enhanced tail rotor. The next four airframes to be modernised have already been inducted into the Itajuba facility, says Helibras. Two previously-completed aircraft – delivered in early 2014 – had received elements of the upgrade outside Brazil. These were used for operational evaluation of the enhancements, prior to a contract signing in October that year covering the army's remaining 32-strong AS565 fleet.

SYSTEMS BETH STEVENSON LONDON

Saab, Finmeccanica set to collaborate on Gripen

Finmeccanica and Saab have signed a memorandum of understanding (MoU) to provide electronic warfare systems support, initially targeted at customers of the latter's Gripen fighter.

The companies will look to support Gripen customers in their use and exploitation of electronic warfare (EW) systems, says Mark Hewer, vice-president of EW Operational Support (EWOS) for Finmeccanica's Airborne and Space Systems division.

"EWOS is capable of supporting Finmeccanica and non-Finmeccanica electronic warfare equipment," he tells *Flight International*. However, he adds: "the initial co-operation with Saab is more likely to focus on Gripen-related programmes".

The Gripen E/NG is on order for the Swedish and Brazilian air forces, and the companies are in discussions with a launch customer for the EW support service,

Hewer says. Their MoU will initially target the South American and Middle East markets, he adds.

All new-generation Gripen ordered will carry the Raven ES-05 active electronically scanned array radar, Skyward-G infrared search and track sensor, plus identification friend or foe systems – all made by Finmeccanica. Saab is also offering the company's BriteCloud expendable active decoy as an option for platform protection.

"With the success of the various Gripen variants internationally, we're seeing real interest [in BriteCloud]," Hewer says. "We look forward to working with Saab and our customers to turn electronic warfare solutions into an operational advantage."

Sweden currently operates the C/D-model Gripen, along with export customers the Czech Republic, Hungary, South Africa and Thailand. ■

ORDNANCE JAMES DREW WASHINGTON DC

Super Hornet extends anti-ship trials

US Navy wraps up load testing of adjusted Lockheed Martin JASSM-ER, with weapon also on target for USAF's B-1B

The US Navy has completed in-flight load testing of the Lockheed Martin-built long-range anti-ship missile (LRASM) on the Boeing F/A-18E/F Super Hornet, and will now move on to conducting noise and vibration trials.

A final flight carrying an inert "mass simulant vehicle" occurred on 6 January over the navy's NAS Patuxent River test site in Maryland, says the US Naval Air Systems Command.

An anti-ship derivative of Lockheed's AGM-158B JASSM-ER extended-range air-to-surface cruise missile, the subsonic LRASM is being certificated for carriage by the Super Hornet and the US Air Force's Boeing B-1B bomber.

LRASM programme manager Capt Timothy Hill says the next

stage of flight certification will begin in late January, with the noise and vibration tests to employ the same test missile, in tandem with another "instrumented measurement vehicle" to collect data.

The first weapons release will occur in "early 2017", Hill adds,

with initial jettison tests to be followed by live trials. "Live-fire tests are planned in 2017 with the B-1B, and continue through F/A-18E/F early operational capability in 2019," says Hill. The latter schedule is also confirmed by Mike Fleming, Lockheed's air-launched LRASM director.

Jointly supported by the USAF and the US Defense Advanced Research Projects Agency, the LRASM programme aims to have the anti-ship weapon integrated with an initial tranche of B-1Bs during 2018. The type has already released several test rounds during early prototype testing, performed against a target ship in 2013. In a maritime conflict, the strategic bomber would be capable of carrying 24 of the long-range weapons, the USAF says.

Once deployed, LRASM will become the USN's most sophisticated air-launched and data-linked anti-ship missile, with the JASSM derivative designed to find targets among flotillas and also survive attempted electromagnetic disruption. ■





ROTORCRAFT JAMES DREW WASHINGTON DC

Saudi deal enhances Romeo's allure

Production for Riyadh to maintain pace of anti-submarine MH-60R as Lockheed/Sikorsky eye further sales opportunities

S

Sikorsky clinched a contract from Riyadh for 10 "green" aircraft in December 2015; seven months after a foreign military sales request worth an estimated \$1.9 billion had been approved by the US government.

Deliveries will begin for Saudi Arabia in July 2018, says Mike Fralen, Lockheed's director of MH-60R business development, and all 10 aircraft will be transferred by April 2019. The Royal Saudi Navy helicopters will feature a dipping sonar and be armed with Lockheed AGM-114 Hellfire air-to-surface missiles and Raytheon torpedoes and guided rockets.



US Navy

Last deliveries to the US Navy are scheduled to occur in 2018

That production schedule aligns with a final delivery to the USN during 2018. The service has received 217 of an eventual 278 "Romeos" since 2005.

Before that milestone is reached, Lockheed says the Royal Australian Navy will accept its last seven of 24 MH-60Rs in August 2016, while a ninth and final example for the Royal Danish Air Force will be transferred by April

2018. An initial pair of the latter's fleet were signed over to the USN last October, to support crew training at NAS Mayport in Florida, and Fralen says six more will be delivered in 2016.

Lockheed says further opportunities to export the MH-60R abound, particularly in the Asia-Pacific region, where territorial disputes have placed several navies on high alert.

"The MH-60R is currently being considered by other countries, and we'll look to see how their analysis and contract decisions mature over the next one to two years," says Fralen.

Sikorsky finishes the S-70/H-60 derivative in Stratford, Connecticut, before Lockheed installs its submarine-hunting mission systems and other cockpit equipment in Owego, New York. The latter, which completed its acquisition of Sikorsky last November, is now leading the global MH-60R sales push against competitors such as the AgustaWestland AW159 and NH Industries NH90.

There are already outstanding sales cases for the MH-60R with South Korea, which had a request for eight aircraft approved by the USA in 2012, and Qatar, which received similar backing for a 10-unit purchase the following year. Taiwan also has expressed interest in acquiring 10 of the type. ■

DEVELOPMENT GREG WALDRON SINGAPORE

Indonesia signs up for KFX fighter collaboration

Korea Aerospace Industries (KAI) and Indonesian Aerospace have signed an agreement for joint development of the KFX fighter, with the pact having been sealed by company leaders at the defence ministry in Jakarta earlier this month.

The agreement sets the stage for Indonesia to share 20% of the development costs for the South Korean-led project, which are estimated at around W8.5 trillion (\$8.3 billion).

The Seoul government will foot 60% of the bill, with KAI and additional industrial partners to cover the final 20%.

Overall, Jakarta's contribution is expected to value "about W1.6 trillion", with Indonesia to provide 1% of the total budget

by April 2016, and 2%-plus starting in 2017.

Indonesian Aerospace – also known as PTDI – will send 100 staff to KAI's Sacheon facilities to assist in the design of the fighter, which is aimed at being more advanced than the Lockheed Martin F-16, but less capable than the same manufacturer's F-35.

In late December 2015 KAI formalised an agreement with the South Korean government to develop the new fighter. It is aiming for a first flight by 2022 and the completion of development activities by 2026.

The Republic of Korea Air Force is expected to acquire 120 of the twin-engined KFX, and Indonesia's air force 80. ■



UAV Solutions

UNMANNED SYSTEMS

Phoenix rises with Romanian army

UAV Solutions has delivered four of its Phoenix 30 unmanned air vehicles to the Romanian army.

The quadrotor aircraft were delivered via the US government's Foreign Military Sales programme, along with the company's Dragon View electro-optical/infrared camera payload, ground control system, spare parts and ground support equipment.

The battery-powered UAV weighs 6kg (14lb), and can carry a 0.9kg payload with a 30-35min endurance. Maximum speed is 24kt (45km/h) and cruise speed is 15kt.

Romania also operates a variant of the Textron Unmanned Systems RQ-2 Pioneer UAV, the Shadow 600. Its army follows the Bulgarian military in acquiring the Phoenix 30, with Sofia also having acquired four examples.



MODIFICATION BETH STEVENSON LONDON

Tokyo's Hawkeyes to be adapted for extended watch

Japan's under-development airborne early warning system to receive in-flight refuelling capability for extended missions

Northrop Grumman has been awarded a \$286 million contract to modify the first E-2D Advanced Hawkeye airborne early warning and control system aircraft now being built for Japan, primarily to prepare it for extended-endurance flights.

Part of a four-aircraft requirement for the Japan Air Self-Defence Force, the lead example was ordered in November 2015, with the adaptation award announced on 5 January.

The US Navy is exploring an in-flight refuelling capability which would enable the E-2D to carry out longer-duration missions after taking off from an aircraft carrier. The modification is expected to be available for use by 2020. Japan, however, deploys its current Hawkeyes from land bases, and its new examples will operate with additional fuel in a "wet wing" configuration.

By using this adaptation, Tokyo's E-2Ds will be able to remain airborne for up to 8h, rather than a usual maximum

Using this adaptation, Tokyo's E-2Ds will be able to remain airborne for up to 8h, rather than 5h

of 5h.

Jay Mulhall, Northrop's director of global strategy and mission solutions, tells *Flight International* that the new E-2D contract covers other Japanese-specific modifications – which he declines to disclose – plus support services and other non-recurring work, such as preparing the aircraft's base at Misawa.

The first delivery for Japan is expected early in 2018, with the nation's defence acquisitions typically allowing for the purchase of one aircraft per year.



US Navy

Export operator will field the E-2D with a "wet wing" modification

Once introduced, the air force's Advanced Hawkeyes will augment, rather than replace, the 13 E-2Cs already in operation, Mulhall says.

Separately, the USN late last year completed its first active deployment of an E-2D unit, with five aircraft from its VAW-125 "Tigertails" squadron –

based at NAS Norfolk in Virginia – having deployed for nine months aboard the USS *Theodore Roosevelt*, as part of its Carrier Air Wing 1.

Mulhall says 22 aircraft from an eventual 75 have been delivered to the USN so far, including six that were handed over during 2015. ■

COLLABORATION

Japan, UK aim for Joint New Air-to-Air Missile development

A meeting of British and Japanese ministers on 8 January resulted in the nations pledging to enter a second phase of discussions regarding the co-development of a proposed Joint New Air-to-Air Missile (JNAAM).

"Following the success of the first round of talks on the co-operative research project on the feasibility of a joint new air-to-air missile, the ministers confirmed discussions would move to the second stage," the UK Ministry of Defence said following the meeting between defence secretary Michael Fallon and foreign secretary Philip Hammond and their

respective Japanese counterparts, Gen Nakatani and Fumio Kishida.

Details on the proposed JNAAM are limited; it was first introduced by the same ministers when they met in London a year earlier. However, a common acquisition of both nations is the Lockheed Martin F-35, with Japan to introduce 42 and the UK planning to field an eventual 138.

MBDA is planning the integration of its Meteor beyond-visual-range air-to-air missile with the F-35, and reports in 2014 suggested that Japan could collaborate to provide the weapon's

seeker.

Japan's Air Self-Defence Force also operates Boeing F-15, McDonnell Douglas F-4 and Mitsubishi F-2 combat aircraft, Flightglobal's Fleets Analyzer database shows.

The ministers also discussed the possibility of Royal Air Force Eurofighter Typhoons visiting Japan later this year for a joint exercise. Their arrival would follow participation in manoeuvres under the Five Power Defence Arrangements; a series of bilateral agreements between Australia, Malaysia, New Zealand, Singapore and the UK. ■

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MANUFACTURING JAMES DREW & STEPHEN TRIMBLE WASHINGTON DC

Boeing faces military orders tussle

Airframer must battle for new business after losing out in LRS-B contest, with several production lines under pressure

Year-end delivery figures for 2015 – released on 7 January – have underscored Boeing Defense & Space's need to capture new business, at a time when its commercial brethren are experiencing record production levels.

A total of 186 military aircraft were delivered by Boeing in 2015, with this volume driven mostly by production of CH-47 Chinook and AH-64 Apache helicopters; at 57 and 61 units, respectively. Deliveries of the US Navy's 737-800-derived P-8A Poseidon rose to 14, from 11 the year before, and for 2016 the manufacturer can look forward to commencing series production of the 767-derived KC-46A tanker for the US Air Force. An initial, 18-aircraft order is expected, pending the outcome of a government review.

WINDING DOWN

But that is where the good news ends. Production of the C-17 strategic transport has come to an end in Long Beach, California, with five aircraft delivered last year and the final examples to follow later during 2016. Assembly of the F/A-18E/F Super Hornet and F-15 in St Louis, Missouri also have bottomed out.

Super Hornet production last year fell by nine aircraft compared with 2014, with 35 aircraft built. Twelve F-15s were assembled; down from 14 a year earlier.

With relatively few new opportunities on the horizon, Boeing faces losing more aircraft lines without further sales of its fighters, or of special-mission aircraft. Just one platform from the latter category was handed over in 2015: the last of four 737-700-derived airborne early warning and control system aircraft to have been produced for the Turkish air force via the Peace Eagle programme.

Completing its military deliveries, the company also transferred one 737-based C-40A transport to the USN.

To arrest this trend, Boeing is



Boeing

The last C-17 strategic transport has left Long Beach, prior to its delivery to the Qatar Emiri Air Force

Keeping its Super Hornet and F-15 production lines running will be just as tough as capturing new business

trying with bid partner Lockheed Martin to reverse the USAF's selection of Northrop Grumman for its 100-aircraft Long-Range Strike Bomber (LRS-B) requirement. The US Government Accountability Office is due to reach a decision by mid-February on the rejected team's protest.

The next big aircraft opportunities are highly competitive, with no clear frontrunners. Boeing is working with Saab in pursuit of the USAF's future T-X trainer contract – which seeks an initial 350 aircraft. It also is proposing a radar-carrying 737-700 for its JSTARS Recap requirement to replace the Northrop E-8C fleet.

Uncertainty still surrounds the USN's unmanned carrier-launched surveillance and strike aircraft programme, although it received substantial new funding from Congress for fiscal year 2016; apparently to mature a second air

craft that can compete against the Northrop X-47B.

Keeping its Super Hornet and F-15 production lines running will be just as tough as capturing such new business opportunities. US lawmakers threw Boeing a lifeline late last year, by funding an additional 12 F/A-18E/Fs and EA-18G electronic-attack aircraft this fiscal year, with the assembly rate due to be wound down to two units per month from later this quarter.

Boeing is still waiting on a potential export order from Kuwait, and will be hoping for continued buys in the USN's next five-year budget submission, which will be revealed during February.

OPPORTUNITIES

Other fighter opportunities include Canada and Denmark, which have begun considering potential alternatives to the Lockheed F-35. Finland also recently began examining replacements for its ageing F-18C/Ds, with the Super Hornet and F-15 both named among a list of seven potential HX programme candidates also including the Dassault Rafale, Eurofighter Typhoon, Lockheed F-16 and F-35, and Saab's Gripen E/NG.

Despite the short-term concerns, Boeing still has ambitions

for the fighter market. Speaking to *Flight International* early last month, Boeing Phantom Works president Darryl Davis said his unit is working on a range of technologies that collectively might enable the US military to dominate the skies in the future.

"You have sensors, airplanes, weapons, electronic effects, cyber – there's a whole kitbag of effects you can apply," Davis says. "You obviously want to defeat your enemy, but there are many ways to defeat an enemy."

The USAF and USN may take different approaches for their respective F-X and F-XX requirements to follow their Lockheed F-22s and F/A-18E/Fs and ensure air dominance into the 2030s. While there is likely to be plenty of commonality, Davis says it is too early to tell if their activities could evolve into a joint endeavour like the F-35, separate aircraft or close derivatives.

Another question is whether such platforms might trade speed and manoeuvrability for the use of long-range weapons.

But the blunt truth is that Boeing will be at a disadvantage if it is unable to reverse the USAF's \$80 billion-plus LRS-B decision, or fails to secure either the T-X or JSTARS Recap opportunities. ■



COMPLETIONS

KATE SARSFIELD LONDON

**Jumbo resumé
shows off LHT's
VVIP capability**

Lufthansa Technik (LHT) has outfitted and delivered its second Boeing Business Jet 747-8 to an undisclosed customer and is currently completing its third example of the VIP widebody.

"The delivery of this second 747-8 is another milestone for us in the area of VVIP completions for widebody aircraft," says Walter Heerdt, LHT's senior vice-president VIP and executive jet solutions.

LHT, headquartered in Hamburg, Germany, is the most prolific outfitter of VIP 747s, with 14 versions of the airliner completed and delivered.

This latest aircraft incorporates new features in its 440m² (4,740ft²) cabin, says LHT. These include an integrated cabin management and onboard entertainment system with broadband internet, wireless local area network, TV and satellite communications equipment.

The company has completed and refurbished more than 100 VIP airliners since it was established in 1994. Of these, around 40 are Boeings, it says.

For its part, Boeing has delivered 213 green narrowbody and widebody BBJs since forming its dedicated business aircraft subsidiary 20 years ago.

In 2015 the company handed over 11 aircraft to completion centres which, in turn, delivered eight outfitted models to customers – five Boeing 737-based BBJs and three BBJ 747-8s. ■



Boeing has handed over 213 green BBJs so far; 11 in 2015

CHARTER KATE SARSFIELD LONDON

Jota boosts fleet with RJ85 purchase

Jota Aviation, the aircraft charter and management division of the Jota Group, has acquired its first Avro RJ85, and is seeking to expand its regional airliner fleet to exploit rising demand in Europe for VIP and large group transport.

The Southend, UK-based company already operates a leased BAe 146-200, and is the largest provider of the Beechcraft King Air 90-series in Europe, with a fleet of four of the type, including a C90 GTx. Jota also operates a single 200-series King Air. The turboprops are used for ad hoc charter, and also provide air support to Jota's motor racing specialist sister company Jota Sport.

The former Brussels Airlines RJ85 (G-CHFE), acquired from Falko, is scheduled to enter service in March on completion of its C-check, cabin refurbishment and exterior repainting. "The air

craft will be re-registered G-JOTR and have a 95-seat layout," says Jota Aviation commercial director Mike Sessions.

Jota says the market for transporting large groups is growing, with sports teams, bands and car manufacturers on promotional

tours using its aircraft. "Our 146 entered service in late 2014, and by the end of last year it had flown over 800h," Sessions says.

Jota says it is also seeing strong demand from Europe's regional airlines, which are seeking supplemental lift. ■



Jota Aviation

Newly-acquired aircraft will join operator's leased BAe 146-200

STRATEGY KATE SARSFIELD LONDON

Gama snaps up Jersey FBO

UK-listed operation to acquire Channel Islands-based Aviation Beauport for over £5 million

Gama Aviation has acquired Jersey business aviation services provider Aviation Beauport for over £5 million (\$7 million).

The acquisition of the Channel Islands-based company – which is expected to be completed in February, subject to regulatory approval – marks the first purchase by Farnborough, UK-headquartered Gama of a business with a fixed-base operation at its core.

"Gama has two FBOs in its portfolio – one in Aberdeen, Scotland and the other in the Emirate of Sharjah – but these were developed as part of our organic growth at both sites," says Gama's chief marketing officer, Duncan Daines.

The purchase of privately-owned Aviation Beauport could trigger similar acquisitions by Gama in the future. "We are always on the look-out for companies that will complement our business," says Daines.

Gama is already one of the largest business aviation services companies in the world, operating across 46 locations with a charter and management fleet of around 150 aircraft.

As well as the FBO, Aviation Beauport brings Gama a large hangar and four managed business jets – a Cessna Citation Mustang, Cessna XLS and XLS+, and a Dassault Falcon 2000.

The company's location is also strategically important for Gama. Jersey – with its low tax regime and secretive companies register – is home to a sizeable community of high-net-worth individuals and is an expanding base for business aircraft. In November 2015, the British crown dependency launched a dedicated private aircraft register to exploit this growing market.

Chris Kelleher, who heads up business development for the Jer-

sey registry, says: "Today we have one aircraft on the register of ZJ-prefixed aircraft and have several more in the pipeline."

The Jersey base will also bolster Gama's European infrastructure ahead of the 2017 launch of Wheels Up's membership-based aircraft programme on the continent, which Gama will support. It already participates in the Beechcraft King Air 350i-based venture in the USA, through its Gama Charters subsidiary.

The acquisition is Gama's first return to the market since its December 2014 reverse takeover of UK-listed Hangar8, which had since 2012 been working on the development of a new 4,650m² (50,000ft²) facility at Jersey airport. Construction of the handling and maintenance hangar – located adjacent to the Aviation Beauport operation – is understood to already be under way. ■



JUDGEMENT KATE SARSFIELD LONDON

Flytenow may fight latest legal setback

Boston-based start-up Flytenow is considering appeal against court ruling which backs US FAA's ban on ride-sharing websites

Ride-sharing start-up Flytenow is considering appealing a US court ruling to uphold the Federal Aviation Administration's ban on public platforms that promote the sharing of private aircraft flights by owners and pilots.

The Court of Appeals for the District of Columbia ruled on 18 December that the FAA's position, issued in August 2014, which declared that such ride-sharing services are commercial operations and that websites promoting them should close, should not be overturned.

The FAA also mandated that pilots who share the cost of expenses with passengers must acquire Part 119 certification, reserved for common carriers, such as airlines.

"The FAA's interpretation is consistent with the relevant statutory and regulatory provisions," the US court declared.

The decision is a huge blow to the fledgling industry, triggering the closure of Boston-based Flytenow's service and that of fellow ride-sharing pioneer AirPooler.

"The FAA has taken a heavy-handed approach to this market," says Alan Guichard, co-founder and chief financial officer of the two-year-old Flytenow. "Now the court is backing them up."

He explains ride-sharing portals such as Flytenow and AirPooler are a forum for pilots with spare seats on small privately-owned aircraft, such as Cirrus

SR22 and Cessna 172 piston singles, to share the cost of expenses with someone "heading in the same direction". "They are not a common carrier as nobody is seeking a profit," says Guichard.

"Pilots have always relied on ride-sharing as a way of reducing their expenses," he continues. "Shared-economy technology just makes that a whole lot easier."

CHALLENGE

He says it is proving a challenge to persuade the US legal system to overrule a government agency. "The current state of the law is extremely deferential to regulatory actions, at the expense of innovation," he says. "The court relied on that regulatory deference, and the result is less choice for consumers and less innovation in general aviation."

Flytenow is refusing to give up, however. "We may lodge an appeal and put our case before all the [Columbia] court judges – only three heard it this time," says Guichard. A Congressional bill – the *Aviation Cost and Expense Sharing Act of 2015* – is also pending. The proposed legislation would allow pilots to communicate with the public, "in any manner the person determines appropriate, to lawfully share expenses with his or her passengers".

"The bill is gaining support from a number of congressmen, and we are optimistic that this industry will finally get the recognition it deserves," says Guichard. ■



Pilots of small types such as the Cessna TTx will be hit



US Forest Service

RETROFIT

USFS Sherpas get flightdeck upgrade

The US Forest Service (USFS), which operates a fleet of fixed-wing fire-fighting aircraft, is upgrading its Shorts SD3-60 Sherpas with the Garmin G950 integrated flightdeck.

The retrofit is to increase mission effectiveness of the ex-US Army twin-engined turboprops and extend the type's operational life within the USFS, where it is deployed for passenger and cargo transportation, fire management and smokejumper missions.

Field Aviation is carrying out the modernisation at its Oklahoma City base, with the first aircraft inducted in October last year.

The engineering company has a contract with the USFS for the enhancement of four aircraft, plus an option to convert the remaining 11 examples.

Supplemental type certification for the upgrade is scheduled for August, leading to delivery of the first aircraft by the end of the third quarter of this year. Modifications on the current additional three Sherpas should be completed by the end of 2017.

REGULATION DOMINIC PERRY LONDON

Corrosion safety warning for Bell 429 tail rotor link

Operators of Bell 429 helicopters have been instructed to conduct urgent inspections of a tail rotor component, after an investigation revealed a potentially dangerous manufacturing defect.

In an emergency airworthiness directive (EAD) effective from 19 January, certification agency Transport Canada warns that corrosion on the part could lead to its failure and subsequent loss of control of the aircraft.

Its warning comes after an in-flight failure of a tail rotor pitch link on a 429. This caused "noticeable vibration" and "difficulty controlling the helicopter", says Transport Canada. ■

A subsequent investigation revealed that the pitch link had fractured, with a crack originating at a corrosion pit.

"Further investigation revealed deficiencies in the application of corrosion resistant finishes to the pitch link during the manufacturing process," says Transport Canada.

Operators are mandated to inspect affected pitch links for signs of corrosion and replace them as necessary.

Bell says the safety of its customers is its "top priority". It issued a safety bulletin to affected operators on 7 December outlining the procedures to check and remedy potential corrosion. ■



PA

AVIATION SAFETY 2015 – THE FACTS

While aviation disasters will always loom large in the public's imagination, the truth is that last year continued a trend towards fewer and fewer accidents and greater passenger safety

DAVID LEARMOUNT LONDON

The year 2015 will go down in aviation history as a watershed, when the focus on passenger safety shifted from technical and operational concerns to security issues.

Airline safety – judged by the relative absence of genuine accidents and disregarding the results of deliberate hostile action – seems to break new records every year, and 2015 was no exception. Potential security risks, on the other hand, are rising – and increasing passenger casualty numbers bear witness to that. Some security risks are familiar but heightened; others are new and, so far, elude solution.

Last year there were nine fatal airline accidents in which a total of 176 people died, compared with 19 events and 671 deaths in 2014. The 19 fatal accidents total was an all-time low, but if the disappearance of Malaysia Airlines flight MH370 in March 2014 should eventually be found to be the result of a deliberate act by

someone on board, the figures would be 18 accidents and 432 deaths. So, between 2014 and 2015, the previous lowest fatal accident total has been halved (see graph, p24).

Flightglobal's Ascend consultancy observes: "If the improvement in air safety since 2010 is maintained for the rest of the current decade, it will equate to some 4,400 fewer passenger and crew fatalities than during 2000-09." Not only have accident numbers



Footage of TransAsia Airways incident



Debris from an Air Canada A320 which hit power lines about 250m short of the runway at Halifax airport on 29 March



The British Airways 777 that suffered a serious engine fire in Las Vegas airport

A Promech Air excursion hit high ground in Alaska's Misty Fjords



PA/Reuters

reduced, accident rates have also plunged (see graphs, p26-27). For complete statistical detail, Ascend's Airline safety and losses annual review 2015 can be downloaded at flightglobal.com/safety2015.

There were no jet accidents in our listing for last year. All of the fatal accidents in 2015 involved small, propeller-driven aircraft, most of them carrying cargo only.

DELIBERATE ACTION

There were two jet disasters in 2015, but they were not accidents. One was the Germanwings crash in the French Alps, deliberately caused by the co-pilot seeking his own death and – perhaps – notoriety. He killed himself and the other 149 people on board. The second jet disaster was the sabotage of the Russian-bound MetroJet Airbus A321 over Sinai, Egypt, in which all 224 people on board died. Evidence points to a bomb having been placed on board the aircraft at its departure airport, Sharm el-Sheikh, but this has yet to be officially confirmed.

So in 2015 more than twice as many passengers and crew – 374 – were killed on airliners by deliberate action than were killed in accidents. The total deaths from all causes was 550, and that is the figure which will colour the perceptions of airline safety among air travellers.

PROPOSALS

HEALTH CONCERN IN THE SPOTLIGHT

THE 24 March Germanwings disaster did not have the hallmarks of terrorism, and instead raised another issue – pilot health – on the psychological rather than physical level.

A European Aviation Safety Agency workshop in Cologne in December gathered 150 experts from authorities, airlines, pilot and cabin crew associations and the medical community. Patrick Ky, EASA executive director, said: "This dialogue... is essential to further strengthen the European aviation safety system. We need to act quickly if we want to minimise the risk of a catastrophe such as the Germanwings accident happening again."

EASA's proposals included the implementation and strengthening of pilot support and reporting systems within the airlines; mandatory psychological evaluation for all



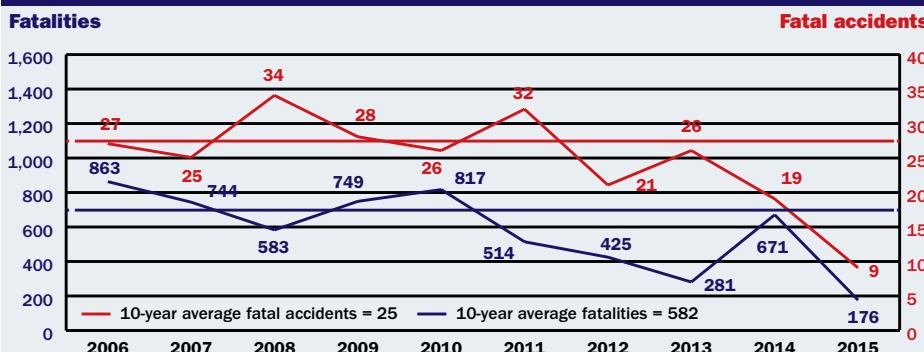
Germanwings Flight 9525 crashed in the French Alps

creation of networks to foster peer support; and the creation of a European repository of pilots' aero-medical data, to facilitate the sharing of information between member states, while respecting patient confidentiality.

EASA says it will now finalise its proposals including the feedback received at the workshop for all of the above areas, and will present a mix of regulatory and non-regulatory proposed measures.

EASA explains: "These papers will undergo focused consultation with the affected stakeholders in early 2016 and can be expected to be implemented over the course of 2016, taking into account any new information arising from the [Germanwings] accident investigation by the Bureau d'Enquêtes et d'Analyses [BEA]."

WORLD AIRLINE FATAL ACCIDENTS AND FATALITIES 2006-2015*



NOTE: *Not including fatal events known to be caused by deliberate action SOURCE: Flightglobal

TransAsia Airways Flight 235 – an ATR 72-600 – crashed into the Keelung River in Taipei on 4 February 2015, killing 43



» Airport and airline security systems as they are operated at present can no longer be assumed to deliver the results that characterised the 14 years since the 11 September 2001 attacks in New York and Washington DC. Measures introduced as a result of 9/11 ushered in heightened airport and onboard security measures that have worked well until very recently. The concern is that the kind of terrorist fanaticism embraced by a movement like the so-called Islamic State (IS) appears to exceed even the zeal of other jihadist groups such as Al Qaeda, and its ability to recruit ordinary people to its cause raises the spectre of security staff and flight or cabin crew being subverted. The latter is not an entirely new threat, but if sabotage is confirmed in the

Airlines will have to put in extra security resources, because governments in many parts of the world do not have the resources or expertise

Sharm el-Sheikh MetroJet case, it demonstrates that weak points in the system can be exploited.

Former head and chief inspector of flight operations at the UK Civil Aviation Authority, Mike Vivian, comments: "The airlines are going to have to put in extra [security] resources, because governments in many



INVESTIGATIONS

ACCIDENT REPORTS PUBLISHED IN LAST SIX MONTHS OF 2015

■ On 29 March 2013 a **Hermes Airlines** **Airbus A321** (SX-BHS) on a charter for Air Méditerranée, following an instrument landing system Cat I approach to runway 36R at Lyon Saint-Exupéry airport, France, overran the far end of the runway by 300m. Investigator BEA said the aircraft, inbound from Dakar, Senegal, via an unscheduled fuel stop in Agadir, Morocco, passed its stabilisation height of 1,000ft on approach at an air-speed 57kt higher than its reference speed. The report continues: "At 140ft, an inappropriate increase in thrust by the autothrust maintained the aeroplane at high speed. The flare was long and the aeroplane touched the runway at 1,600 metres past the 36R threshold. The aeroplane overran the runway and came to rest approximately 300 metres after the opposite threshold." The report notes the crew had failed to recog-

nise the significance in the arrival weather report of strong tailwinds during the descent and lesser tailwinds during the final approach and that, in addition, speed management during the entire descent was poor. Finally, an autothrottle anomaly related to the high air-speed at the flare extended the flight runway even further. The crew had been on duty for 15h, and their decision-making after the overrun was slow – air traffic control had to remind them to shut down the engines. No-one was injured.

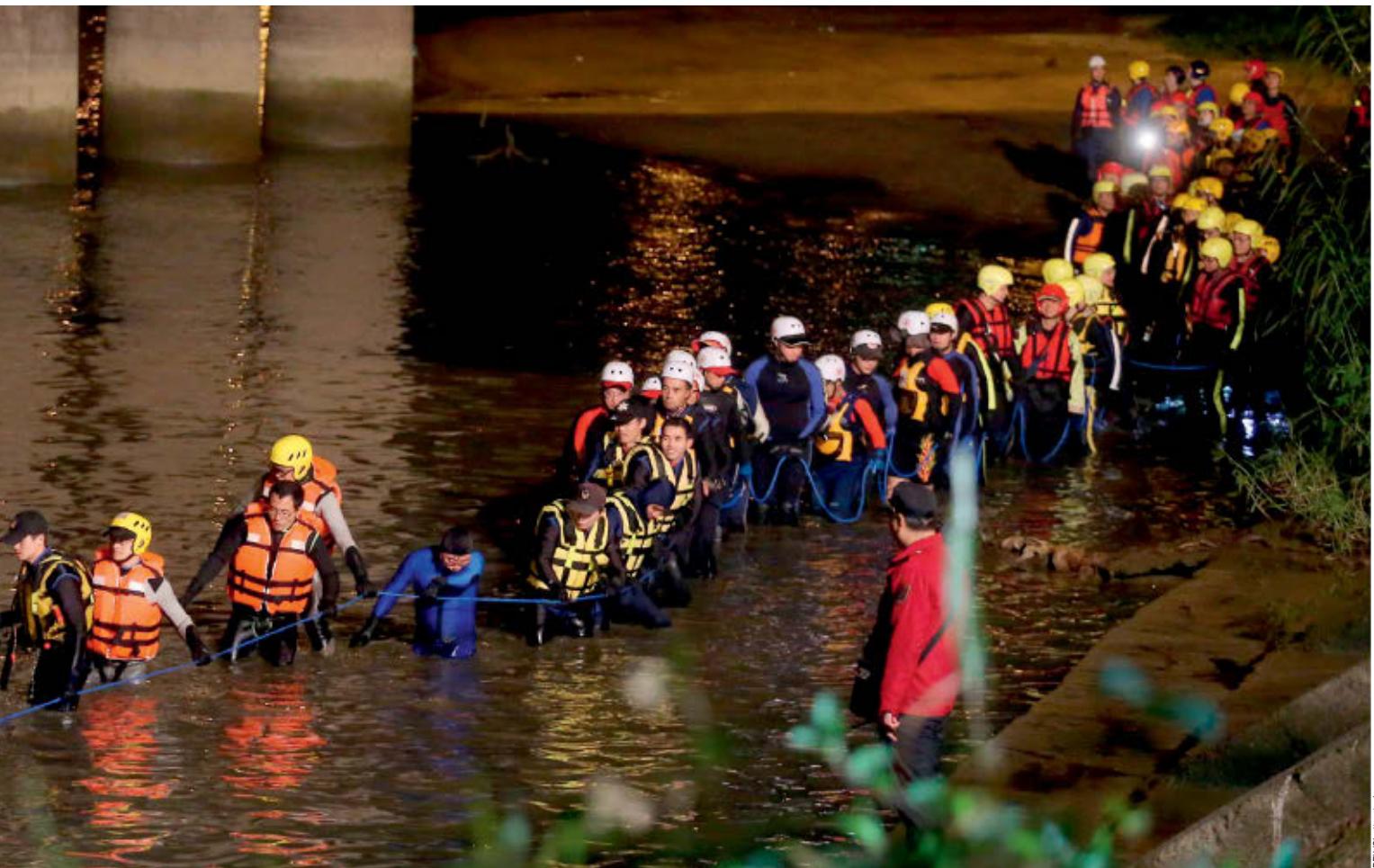
■ The final Indonesian report on the 28 December 2014 **AirAsia Indonesia** **Airbus A320** crash in the Java Sea killing all 155 passengers and seven crew onboard says an electrical fault – known to the airline and the captain but not resolved – caused an electronic centralised aircraft monitor alert announcing a fault in the rudder

travel limiter unit (RTLU). This alert was repeated three times and the crew dealt with it according to the checklist. On the fourth such alert, the captain attempted to resolve the issue by tripping and resetting the circuit breakers for the flight augmentation computers (FAC). The aircraft was in the cruise at 32,000ft and the autopilot had been coping with the control effects of the electrical fault, which had offset the rudder 2° to the left. But when the autopilot tripped out, the offset rudder caused the aircraft to roll left to a 54° angle of bank, and control law changed from normal to alternate. The report says the electrical fault was caused by a crack in the solder on a printed circuit board associated with the RTLU. The co-pilot was flying, and he failed to take action immediately to roll the wings level, so the nose dropped. Some 9s later, when he did roll the wings almost level

(to 9° left bank), he also pulled the nose up, but then he let the bank angle return to 53° left and the pull-up demand on the co-pilot's sidestick moved to maximum; actions that suggest the co-pilot was disorientated. The aircraft climbed to a

The crew had been informed of 22kt winds gusting to 37kt but did not carry out an approach briefing

maximum height of 38,500ft, triggering the stall warning, and beginning a stalled descent at a rate of 20,000ft/min until impact with the sea. The co-pilot's sidestick remained at the full nose-up demand throughout. There is evidence the captain may have left his seat to trip the FAC circuit breakers.



REX/Shutterstock

At one point he gave the co-pilot the confusing instruction to "pull nose-down" (the pilots were different nationalities and neither was a native English speaker), but he failed to act correctly to take override control with his sidestick.

■ The US National Transportation Safety Board has published an interim report on a 13 March 2014 rejected take-off at Philadelphia that reflected a crew failure to re-enter necessary take-off data when the take-off runway was changed. The co-pilot of the **US Airways Airbus A320** (N113UW) entered take-off information for runway 27R into the multipurpose control and display unit (MCDU) when the crew intended to takeoff from Runway 27L. The captain noticed the discrepancy while taxiing, and the co-pilot corrected the runway to be used but did not re-enter the take-off speeds and "flex temperature"

that determine take-off thrust, despite a message reading "CHECK TAKE OFF DATA". Passing 80kt, a computer voice warned "retard", and the electronic centralised aircraft monitor issued the message "ENG THR LEVERS NOT SET". The captain continued the take-off with the thrust he had set, but when approaching 120kt, the pilots noticed the take-off V-speeds were absent from the speed tape. The captain continued the take-off roll and rotated around 160kt, then a moment later aborted the take-off. The nose gear collapsed on hitting the runway hard. The aircraft came to a halt on the runway and a passenger evacuation was carried out. The NTSB comments: "Recently we have experienced a number of unnecessary rejected take-offs because a flex temperature was omitted in the MCDU." The memo reminds pilots they can continue a take-off without flex temperature by

advancing throttles to take-off or go-around power.

■ Italy's accident investigation agency ANSV, examining a 2 February 2013 accident at Rome Fiumicino airport, reports a **Carpatair ATR 72-500** landed in gusting wind conditions that exceeded the aircraft's operating limits. Following a night approach to runway 16L, the aircraft bounced from a nose-down touchdown, and then oscillated in roll during the second runway impact, which also damaged the main gear. The crew had been informed of 22kt winds gusting to 37kt, but did not carry out an approach briefing and so did not discuss this. The captain – the pilot flying – had 9,600h on type and the co-pilot only 15h. The final approach was flown fast, at 130kt instead of the correct 118kt. After the initial nosewheel impact and bounce the captain was pushing

forward on the controls, the co-pilot pulling back, which resulted in the controls decoupling. This led the aircraft to roll slightly left and it bounced off each main landing gear, wrecking both, leaving the aircraft to slide on its fuselage belly for some 400m, rotating through nearly 180° as it veered off the runway and came to a halt on grass.

■ South Korean investigators are unable to be certain of the origin of the fire which brought down an **Asiana Airlines Boeing 747-400** freighter off Jeju island on 28 July 2011. The inquiry believes it started in the vicinity of two pallets of dangerous goods on the aft main deck. Just 3min after the flight was handed from Incheon to Shanghai area control, the crew requested an emergency descent from 34,000ft to 10,000ft, citing a main-deck fire. The inquiry points out two pallets close to the rear freight door ➤

parts of the world do not have the resources or expertise to provide the input that is going to be required in the 'new order'."

A rare but potentially serious issue is that of pilot mental health, as illustrated by the Germanwings crash; the mysterious disappearance of Malaysia Airlines flight MH370 in March 2014 may also be found to have been the result of deliberate action by somebody on board.

There have been a handful of fatal airline crashes since 1994 caused by known or suspected crew suicide or revenge action – including the 2013 LAM Mozambique Embraer 190 loss that has many parallels with the

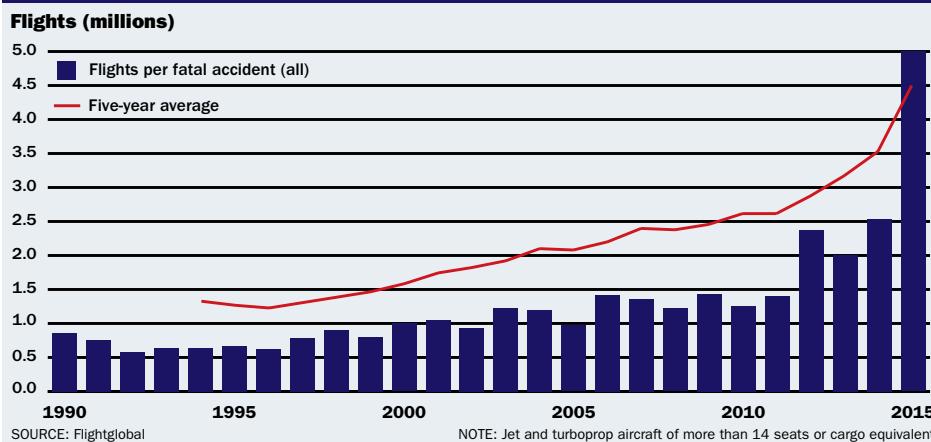
There have been a handful of fatal airline crashes caused by suspected crew suicide, but the likelihood of such events remains extremely low

Germanwings case – but based on the historic figures, the statistical likelihood of such events remains extremely low. But the European Aviation Safety Agency has taken up the issue and hopes to propose workable measures this year to counter the risk (see p23).

Despite the dramatic reduction in operational and technical accidents, the airlines cannot relax and reduce their vigilance, because attention to detail is what has brought the industry the high standards it enjoys. The world still has its problem regions for accident risk, and Indonesia is just one of them (see tables, from p28).

However Indonesia's relatively new transport minister, Ignasius Jonan, has promised he will continue to take a tough stance to push local carriers to improve safety standards, as the country aspires to bring in more tourists. Referring to firm action he took following the crash of AirAsia

2015 FLIGHTS PER FATAL ACCIDENT



MetroJet Flight 9268 is thought to have been brought down by a bomb on board



Xinhua/REX/Shutterstock

CONTINUED

ACCIDENT REPORTS PUBLISHED IN LAST SIX MONTHS OF 2015

had been carrying lithium-ion batteries as well as highly-flammable and corrosive liquids. Data relayed by the ACARS communication system shows the initial fire alert was triggered in main deck zone 11, just ahead of the rear freight door. Critical flight systems were lost in rapid succession and the pilots – who stated the aircraft was shaking "violently" – were unable to maintain altitude. The crew told Jeju approach they were going to attempt a ditching, but there was no further contact. Both crew were killed when the aircraft crashed into the sea.

French and Malian investigators are advising a mandatory change to **Boeing MD-80** flight manuals to highlight potential insidious effects of engine icing. The recommendation follows the inquiry into the fatal loss of a **Swiftair MD-83** in July 2014, which has been attributed to

an undetected speed decay triggered by inaccurately sensed engine pressure ratio data. Investigators believe the crew failed to activate the anti-icing system for the pressure probes on the nose cones in the MD-83's engines and they became obstructed by ice as the aircraft diverted around a region of convective weather shortly after reaching its cruise altitude of 31,000ft. The probes relayed an overestimate of the engine pressure ratio and the aircraft responded by reducing thrust to bring the figure within limits, with the decreasing speed unnoticed until the aircraft began to stall. The inquiry observes: "As of today, documents such as the [flight manual] do not contain specific procedures to allow crews, on the basis of indicated engine parameters, to bring to light a situation with inconsistent [engine pressure data] resulting from obstruction of

the [engine probes]." It adds that pilots should be provided with a means to identify quickly an erroneous pressure-ratio reading.

The US NTSB says the **Southwest Airlines 22 July 2013 Boeing 737-700** (N753SW) landing accident at New York LaGuardia airport resulted from an unstable approach and the captain's decision to take command of the aircraft at low altitude. The report says: "The captain should have called for a go-around when it was apparent that the approach was unstabilised, well before the point that she attempted to salvage the landing by taking control of the airplane at a very low altitude." The aircraft "landed hard"; the nose gear impacting the runway first, driving the nose gear strut into the electronics equipment bay. The aircraft veered right before stopping

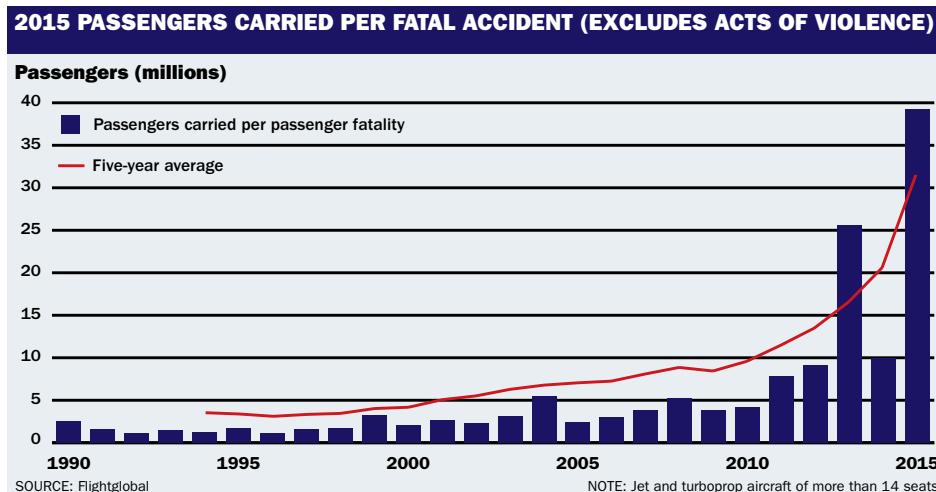
on the right side of the centreline of runway 04. Eight of the 149 passengers and crew suffered minor injuries. On final approach, the captain had noticed that the flaps were not set at 40°, and lowered them as the aircraft descended through about 500ft. The aircraft was above the glideslope passing 200ft. Then, passing 27ft, the captain said "I got it" and took control of the aircraft. The aircraft hit the runway at a descent rate of 960ft/min and a nose-down pitch attitude of -3.1°.

In a fatal accident at Kazan on 17 November 2013, pilots of a **Tatarstan Airlines Boeing 737-500** had not realised the autopilot had disengaged as they attempted a go-around, according to the final report by Russia's Interstate Aviation Committee. The agency says two "weak" pilots, with poor training, had been paired on the



ZUMA/Xinhua/REX/Shutterstock

A Turkish Airlines A330 suffered a nose gear collapse after a runway excursion on landing at Kathmandu airport, Nepal, on 4 March 2015



Indonesia flight QZ8501 in December 2014, and speaking at the 2015 Association of Asia Pacific Airlines' annual assembly in Bali, he stated: "The aviation industry in Indonesia today may not like me, but that's okay."

Jonan also stated that the Indonesian government has allocated \$1 billion to improve transport safety in 2016 – the largest sum to be invested in a single year since the nation's independence.

Other nations have successfully managed to correct poor safety performance, and results for the world as whole have never been so good, so it can be done. ■

 Download Flightglobal Ascend's Airline safety and losses annual review 2015 at flightglobal.com/safety2015

flight from Moscow, creating a "significant safety risk". The 737 had been considerably off course as it made its initial approach to Kazan, using the standard UW29D approach pattern to runway 29, ending up far to the right of the runway extended centreline and unable to capture the instrument landing system localiser. The inquiry cited "map shift", which it attributed partly to incorrect data on the aircraft's location, fed to the inertial reference system before departure from Moscow Domodedovo. The pilots opted to execute a go-around from the badly-positioned approach at around 270m (900ft) above the runway. The inquiry says the crew was probably "not psychologically ready" for a missed approach, despite having discussed the possibility. The 737 pitched up significantly when power was applied, breaching the 500m specified height for a

The inquiry says the crew was probably "not psychologically ready" for a missed approach

go-around, before levelling off at some 700m and entering a 75° nose-down dive from which it did not recover, hitting the ground at 240kt just 43s after the go-around had been initiated. None of the 50 occupants survived. Investigators believe somatogravic illusion – acceleration-induced misperception of the aircraft's attitude – may have been a factor. The inquiry criticises the airline's "non-functional" safety management system, a lack of control over the training regime for the crew and disorganisation in crew duty and rest schedules.

■ **Qantas** has updated its training for visual approaches after an incident in which the crew of an **Airbus A330-200** (VH-EBV) misjudged an approach into Melbourne airport, resulting in warnings from the aircraft's enhanced ground proximity warning system (EGPWS). The approach was in daylight during the early evening of 8 March 2013, says the Australian Transport Safety Bureau (ATSB). The aircraft was inbound from Sydney with 11 crew and 211 passengers. The captain and first officer were at the end of a five-day roster pattern and had flown a Perth-Sydney service earlier that day. After being cleared for approach, the captain set an altitude target of 1,000ft, selected gear down, and 180kt as the target speed. As the aircraft descended through 1,800ft, the first officer told the captain the aircraft was low. The captain reduced the rate

of descent, but then the EGPWS issued "Terrain" alerts followed by the command to "Pull Up." At this point the aircraft was at 1,400ft above sea level, but only 600ft above the ground and 1,900ft below a normal 3° descent profile. The captain applied full power and conducted a go-around before landing uneventfully. The ATSB found that during the visual approach the captain's performance capability was probably reduced due to the combined effects of disrupted and restricted sleep, a limited recent food intake and a cold/virus. The ATSB also noted: "The combination of the selection of an ineffective altitude target while using the auto-flight open descent mode and ineffective monitoring of the aircraft's flight path resulted in a significant deviation below the nominal descent profile." ■

ACCIDENTS AND INCIDENTS 2015

NOTES ON TABLES

This data comes from *Flight International's* research in association with Flightglobal advisory service Ascend, which compiles the *World Aircraft Accident Summary*, among other safety analysis products. Details of non-fatal incidents are not made available officially by authorities in many countries, but *Flight International* continues to list known significant incidents to maximise the availability of relevant information. We accept that the non-fatal listing may be weighted against the airlines of those countries that make safety information more readily available.

GLOSSARY OF TERMS AND ABBREVIATIONS

AA airfield approach/early descent	EFIS electronic flight-instrument system	GPWS ground proximity warning system	PF pilot flying
AAIB UK Air Accidents Investigation Branch	EGPWS enhanced ground proximity warning system	HP high pressure	PNF pilot not flying
AAL above airfield level	EGT exhaust gas temperature	IFR instrument flight rules	RA runway/final approach
ACARS automatic communication addressing and reporting system	EICAS engine indicating and crew alerting system	ILS instrument landing system	SID standard instrument departure
ADC air-data computer	ER en route	IMC instrument meteorological conditions	TAWS terrain awareness and warning system
ADF automatic direction finder	ETOPS extended-range twin operations	ISA international standard atmosphere – sea level pressure of 1013.2hPa and standard temperature/pressure lapse rate with altitude	TO take-off
AF air force	FAA US Federal Aviation Administration	L landing	TOGA press-button selected take-off/go-around thrust
AGL above ground level	FDR flight data recorder	LP low pressure	VASI visual approach slope indicator
AMSL above mean sea level	FL flight level = altitude, in hundreds of feet, with international standard pressure-setting (ISA) of 1013.2mb set on altimeter (eg FL100 – altimeter reading of 10,000ft with ISA set)	MEL minimum equipment list	VFR visual flight rules
AOA angle of attack	FMS flight management system	MTOW maximum take-off weight	VHF very high frequency
ASI airspeed indicator	G on ground	NDB non-directional beacon	VMC visual meteorological conditions
ATC air traffic control	GPU ground power unit	NTSB US National Transportation Safety Board	VOR VHF omni-range navigation beacon
C climb		PAPI precision approach path indicator	V₁ take-off decision speed
C-B circuit breaker		PAX passengers	
CFIT controlled flight into terrain			
CNK cause not known			
CVR cockpit voice recorder			
DME distance measuring equipment			
ECAM electronic centralised aircraft monitor			

Date	Carrier	Aircraft type/registration	Location	Fatalities (crew/pax)	Total occupants (crew/pax)	Phase
FATAL EVENTS: SCHEDULED PASSENGER FLIGHTS						
24-Mar	Germanwings	Airbus A320 (D-AIPX)	Barcelonette, France	6/144	6/144	ER

The aircraft was carrying out a scheduled flight from Barcelona to Düsseldorf. When the captain was out of the flightdeck early in the cruise, the co-pilot refused him re-entry and put the aircraft into a high speed descent until impact with the ground. Releases by the French prosecutor and the investigator (BEA) based on FDR and CVR information suggest the co-pilot's action was deliberate.

31-Oct	MetroJet	Airbus A321 (EI-ETJ)	Sinai, north of Sharm el-Sheikh airport, Egypt	7/217	7/217	ER
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The aircraft was lost to ATC with no radio call, just having reached its cruising flight level, and wreckage was found over a wide area. Although much work on the investigation is yet to be done, it has been accepted by most parties to the investigation that the most likely finding is that the aircraft was brought down by a bomb placed on board. The aircraft, although Irish registered, was operated by Russian carrier MetroJet, and all the passengers and crew were Russian.

FATAL EVENTS: NON-SCHEDULED PASSENGER FLIGHTS						
Date	Carrier	Aircraft type/registration	Location	Fatalities	Total occupants	Phase
20-Jan	Olimp Air	Antonov An-2 (UP-A0314)	North of Bishkek, Kazakhstan	6	7	ER
			The aircraft, more than 40 years old, was chartered by a minerals company to take employees from Balkhash to a mine.			
25-Jun	Promech Air	DHC Vazair Turbine Otter (N270PA)	Nr Ella Lake, Alaska, USA	1/8	1/8	ER
			The commercial excursion flight, operating out of Ketchikan, was carrying passengers from a Holland-America cruise liner on a sightseeing trip in Alaska's Misty Fjords when the aircraft hit high ground.			

FATAL EVENTS: REGIONAL AND COMMUTER AIRLINES						
Date	Carrier	Aircraft type/registration	Location	Fatalities (crew/pax)	Total occupants (crew/pax)	Phase
04-Feb	TransAsia Airways	ATR 72-600 (B-22816)	Taipei Sung Shan airport, Taiwan	4/39	5/53	C
			The No 2 engine flamed out in the early climb after take-off, but mistakenly the crew retarded the throttle for the No 1 engine and closed the fuel shut-off valve for it. With about 1,400ft height, the crew did not have sufficient time to identify what had happened and attempt a successful relight of the No 1 engine. Descending with no power and with the stall warning operating, the aircraft's left wing dropped to about 90° bank and struck a roadside barrier before the ATR crashed into the Keelung river. The Taiwan investigator has since revealed the aircraft's automatic take-off power control system (ATPCS) had not been armed when the crew began the departure roll. The monitoring pilot voiced this fault, which the airline says is trained as an abort condition, but the take-off was continued. The ATPCS provides automatic support – including trim and auto-feathering – in the event of an engine failure during take-off.			
16-Aug	Trigana Air	ATR 42 (PK-YRN)	Mount Tanggo, Indonesia	5/49	5/49	AA
			The aircraft hit high ground during a daylight descent toward its destination at Oksibil. The impact point was at 8,300ft, about 4,000ft above the airfield elevation and 10nm north west of Oksibil airport. The aircraft had its flaps and gear extended at impact. It was the crew's second trip to Oksibil that day, and at their last radio exchange they reported descending through 11,500ft. ATC asked the crew to report overhead the aerodrome, which is standard procedure, followed by a right hand circuit for runway 11, but the crew replied they would go for a left base leg onto final approach for runway 11. The visibility was good but there was cloud at 8,000ft.			



Xinhua News Agency/REX Shutterstock

Wreckage from the MetroJet crash in Sinai; and the Trigana Air incident at Mount Tanggo, which killed 54 passengers and crew

Date	Carrier	Aircraft type/registration	Location	Fatalities (crew/pax)	Total occupants (crew/pax)	Phase
02-Oct	Aviastar Mandiri	DHC Twin Otter (PK-BRM)	Gunung Latimojong, South Sulawesi, Indonesia	3/10	3/10	ER

The aircraft reported reaching its cruising altitude of 8,000ft en route from Masamba to Makassar, but later crashed into the eastern slope of Gunung Latimojong at the 7,000ft level.

FATAL EVENTS: NON-PASSENGER FLIGHTS

13-Apr	Carson Air	Swearingen Metro II (C-GSKC)	Nr Vancouver, Canada	2	2	C
The aircraft disappeared from radar only a little more than 5min after departure from Vancouver. Canada's Transportation Safety Board says radar shows a rapid descent from a flight path apex of about 7,000ft altitude that was consistent with loss of control. Before that point the crew had not indicated any problems, and there was no emergency call.						
02-Jun	Aeronaves	Swearingen Metro (XA-UKP)	Santiago de Queretaro, Mexico	2/3	2/3	C
Soon after take-off for a post-maintenance test flight, the aircraft was recorded on video in an almost vertical dive about 6nm from the airport.						
04-Nov	Allied Services	Antonov An-12 (EY-406)	Juba, South Sudan	6/37	6/38	TO

The aircraft failed to gain height after take-off and crashed about 1,000m from the upwind end of the runway. There was only one survivor, and although this was supposed to be a cargo flight carrying food, there were evidently many passengers on board, in fact the Red Cross say more bodies may yet be found because the numbers on the aircraft were not known.

11-Dec	Wasaya Airways	Cessna Caravan	15nm north-east of Pickle Lake, Ontario, Canada	1	1	ER
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The aircraft crashed in bad weather en route from Pickle Lake airport to Angling Lake airfield, Ontario.

Date	Carrier	Aircraft type/registration	Location	Injuries (crew/pax)	Total occupants (crew/pax)	Phase
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SIGNIFICANT NON-FATAL EVENTS (ALL COMMERCIAL AIRLINE OPERATIONAL CATEGORIES)

02-Jan	Flybe	Saab 340B (G-LGNL)	Stornoway airport, Scotland	-/-	3/25	TO
The Loganair-owned aircraft, inbound from Glasgow to land on runway 18 at Stornoway, veered off the runway to the left and its nose gear collapsed on the soft ground. The wind was westerly at 22kt gusting to 33kt, visibility good, temperature 5°C.						
03-Jan	KAPO Avia	Antonov An-26B (RA-26082)	Magadan-Sokol, Russia	-	8	TO
The crew aborted take-off at more than 130kt and overran the end of the runway in snowy conditions. The right main gear collapsed, damaging the propeller and wingtip. The crew had failed to complete their take-off checks so the control gust-locks were still engaged, hence the elevator would not move.						
10-Jan	ASKY Airlines	Boeing 737-400F (ET-AQV)	Accra Kotoka airport, Ghana	3	3	L
During the daylight landing on runway 03, the aircraft, inbound from Lome, Togo, veered off the side of the runway and ground-looped, causing all the gears to collapse and the right engine to separate. There was a strong, gusting wind and visibility was reduced by dust and haze.						
11-Jan	Trigana Air Service	DHC Twin Otter (PK-YRU)	Enarotali airport, Indonesia	-	3	L
Inbound from Tembagapura, the aircraft landed in windy conditions and veered off the runway. The nose-gear collapsed and both propellers were damaged.						
23-Jan	Air Inuit	Bombardier Dash 8 (C-FYAI)	Umiujaq airport, Quebec, Canada	-/-	3/27	TO
There was a tailstrike at rotate, but the crew did not notice it and continued to their destination, Kuujjuaq, where the damage was found to be substantial.						
02-Feb	Sky Express	BAe Jetstream 41 (SX-DIA)	Rhodes Diagoras airport, Greece	-/-	2/14	L
Landing on runway 07, inbound from Heraklion, Crete, with wind from the southeast and a windshear alert active at the time, the aircraft encountered windshear and landed hard. The left main gear collapsed.						
03-Feb	Garuda Indonesia	ATR 72 (PK-GAG)	Lombok airport, Indonesia	-/-	4/25	L
The aircraft, inbound from Denpasar, Bali, veered off runway 13 on landing and the nose gear collapsed.						
15-Feb	Air India	Airbus A321 (VT-PPD)	Mumbai International airport, India	-/-	7/187	L
On a daylight approach in 4,000m visibility, the aircraft made a hard, bounced landing and tailstrike on runway 27. The first touchdown registered 1.66g, and after the bounce the deceleration was more than 3g.						
24-Feb	Jazz	Bombardier Dash 8 (C-GTAI)	Sault Sainte Marie airport, Ontario, Canada	-/-	3/15	L
On a night approach inbound from Toronto, the aircraft touched down about 150m short of runway 30, but continued forward until coming to a stop on the runway. The gear suffered major damage.						

Date	Carrier	Aircraft type/registration	Location	Injuries (crew/pax)	Total occupants (crew/pax)	Phase
26-Feb	Cargojet Airways	Boeing 757 (C-GIAJ)	St John's airport, Newfoundland, Canada	-	2	G
The aircraft began to slide sideways across the icy ramp as the crew attempted to taxi the 757 to its parking position. There were strong, gusting winds. The crew were unable to stop the slide, and the aircraft continued 60m until it hit a building at the edge of the ramp, which was reported as being 80% covered by ice.						
04-Mar	Turkish Airlines	Airbus A330-300 (TC-JOC)	Kathmandu Tribhuvan airport, Nepal	-/-	11/227	L
The aircraft, inbound from Istanbul, carried out a VOR/DME letdown to runway 02, and abandoned it at about 1nm DME. The aircraft circled for a second approach, but on landing it veered off the left side of 02 and the nose gear collapsed.						
04-Mar	Deraya Air Taxi	BAe ATP freighter (PK-DGB)	Wamena airport, Indonesia	-	2	L
On a daytime approach to runway 33 in low cloud and heavy rain, the aircraft tracked to the left of the extended centreline. When it touched down, the aircraft heading was at an angle to the runway centreline and it ran off the right side into the grass. The crew brought it back onto the runway but the nose undercarriage and left main gear collapsed.						
05-Mar	Delta Air Lines	Boeing MD-88 (N909DL)	New York LaGuardia airport, USA	-/-	5/125	L
Landing from an ILS approach to runway 13 in freezing fog and with about 800m visibility and a light crosswind from the left, the aircraft veered off the runway to the left and destroyed a long section of the perimeter fence with its wing before coming to rest, its forward fuselage resting on a berm and nose protruding over Flushing Bay.						
08-Mar	SpiceJet	Bombardier Dash 8 (VT-SUA)	Hubli airport, Karnataka, India	-/-	4/74	L
Following a night approach in heavy rain associated with thunderstorms, the aircraft veered off the runway and its left main gear collapsed.						
14-Mar	Malaysia Airlines	Airbus A330 (9M-MTA)	Melbourne airport, Australia	-/-	?/?	L
A heavy landing caused major damage to the main gear, but the aircraft was able to taxi to the gate and disembark the passengers normally.						
29-Mar	Air Canada	Airbus A320 (C-FTJP)	Halifax airport, Canada	-/23	5/133	L
The aircraft, on a flight from Toronto, was carrying out a night localiser-only approach to runway 05 in snow with poor visibility and a crosswind from the left. On short final approach the aircraft hit power lines about 250m short of the runway and then impacted a localiser antenna array. The gear was severely damaged, both engines separated, and there was extensive damage to the aircraft belly and the wing and tail leading edges.						
14-Apr	Asiana Airlines	Airbus A320 (HL7762)	Hiroshima airport, Japan	-/-	8/74	L
The aircraft was on a night-time satellite-guided RNAV approach to runway 28, inbound from Incheon, South Korea, when it hit an approach light at a height of 4m before striking the localiser antenna array some 325m short of the runway 28 threshold, then veered left off the runway suffering substantial airframe damage. Preliminary findings by the Japan Transport Safety Board (JTSB) report light rain and fog giving 300m RVR. The aircraft initially followed the correct descent profile, says the JTSB, but after its autopilot was disconnected at around 2,100ft, it began to drift below the normal glidepath with its airspeed constant at around 130kt. The glidepath deviation gradually became more pronounced until the aircraft hit the localiser.						
16-Apr	Key Lime Air	Swearingen Metro III (N2691W)	Nr Rifle, Colorado, USA	-	1	C
During the night climb out of Rifle en route to Denver, the No 2 engine suffered an uncontained second stage turbine failure and a fire warning. After completing shutdown and fire drills the pilot diverted to Grand Junction Regional Airport, Colorado where he landed safely. Turbine sections had smashed through the engine casing and penetrated the aircraft fuselage.						
20-Apr	Wings Air	ATR 72 (PK-WGS)	Sumbawa Besar airport, Indonesia	-/-	3/70	L
The aircraft made a hard (+4.8g) bounced landing at Sumbawa Besar. The crew carried out a go-around and returned to Lombok where a safe landing was made some time later. The weather conditions and visibility were poor.						
25-Apr	Turkish Airlines	Airbus A320 (TC-JPE)	Istanbul Ataturk airport, Turkey	-/-	6/91	L
The aircraft rolled right just before touchdown on runway 05, caused serious damage to the right main gear and the engine casing, and the crew decided to go around. During its climb away, flames were observed in or near its No 2 engine. The aircraft made an approach to runway 35L, but on touchdown the right main gear failed, the No 2 engine struck the runway and the aircraft slewed right nearly 180°, coming to rest off the runway.						
05-May	AirAsia	Airbus A330 (9M-XXW)	Kathmandu airport, Nepal	-/-	314	L
The main undercarriage was damaged in a hard landing on runway 02, although the landing was completed safely. Reports say the aircraft developed a high rate of descent during short final approach. This may have been caused by windshear.						
10-May	Joy Air	Xian MA60 (B-3476)	Fuzhou airport, China	-/-	7/45	L
The aircraft made a very heavy landing (+6g) on runway 03, the wing and engines twisted downward, and the aircraft came to rest about 500m beyond the runway threshold and about 50m to the right of the runway. It seems the co-pilot, who was pilot flying, retarded the power levers into the "ground idle" quadrant while the aircraft was still about 40ft above touchdown, and the aircraft's rate of descent became very high. The weather conditions and visibility were good.						
1 July	Air Méditerranée	Airbus A321 (F-GYAP)	Tarbes/Lourdes airport, France	-/-	6/222	L
Inbound from Belfast, a hard landing in daylight VMC caused the aircraft major damage. The flight was operated on behalf of Hermes Airlines.						
2 July	Trans Maldivian Airways	DHC Twin Otter (8Q-MAN)	In sea 2nm from Kuredhdhoo Resort, Maldives Islands	-/-	3/11	ER
Carrying passengers from Male international airport to Kuredhdhoo resort, a float broke off when the aircraft touched down on the water about 2nm short of its destination. The reason for the precautionary sea landing has not been reported except by the local press, which quoted engine failure.						
6 July	Emirates	Boeing 777 (A6-EWD)	Lagos International airport, Nigeria	-/-	?/?	G
The Emirates 777 was taxiing at night for take-off on runway 18L when it struck the tail and rudder of a Hak Air Boeing 737 (VP-BYT) parked empty on the domestic apron, causing major damage.						
19 July	British Airways	Airbus A321 (G-EUXF)	Glasgow airport, Scotland	-/-	7/200	L
The aircraft suffered a tailstrike during a landing on runway 23, inbound from London Heathrow in dusk VMC, causing major damage.						
24 July	Air Bagán	ATR 72 (XY-AIH)	Yangon Int airport, Myanmar	-/-	5/49	L
The aircraft, inbound from Mandalay, ran off the left side of runway 21 onto soft ground, and the nose and left main gear collapsed. The aircraft was judged a total loss, but unconfirmed reports suggest some damage occurred during the recovery.						
12 August	Mountain Air Cargo	Cessna Caravan (N924FE)	In sea off Saba, Netherlands Antilles	-	1	ER
En route from Puerto Rico to St Kitts, the aircraft began its descent from FL110 when engine problems began. Smoke entered the cockpit, the oil pressure began to fall, and ultimately oil began to cover the windscreen. Passing 8,000ft the engine failed. The pilot elected to ditch the aircraft about 0.5nm off the Saba coast, and was rescued, but the aircraft sank.						
15 August	American Airlines	Airbus A321 (N564UW)	Charlotte Douglas airport, USA	-/-	6/153	L
The aircraft hit windshear on final approach to runway 36L and damaged approach lights before the crew elected to go around. It then returned to land safely on 36C.						
28 August	First Flying	Viking Twin Otter (JA201D)	Aguni airport, Okinawa, Japan	-/-	2/12	L
The aircraft appeared to lose directional control and veered right off runway 19, crossing a drainage ditch and suffering major damage.						
28 August	Cardig Air	Boeing 737 (PK-BBY)	Wamena airport, Papua, Indonesia	-	2	L
This cargo flight touched down hard (3.8g), 35m short of the runway 15 threshold with a gusting headwind straight along the runway in good daylight visibility. The VASIS were out of action. The aircraft came to rest on the runway but the left main gear had partially collapsed.						



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74 passengers and eight crew escaped injury when an Asiana Airlines Airbus A320 hit the localiser antenna at Hiroshima airport, Japan

Date	Carrier	Aircraft type/registration	Location	Injuries (crew/pax)	Total occupants (crew/pax)	Phase
5 September	Ceiba International	Boeing 737 (3C-LLY)	Airway UA61 over Ghana	-/-	?/?	ER
			The aircraft, en route Dakar, Senegal to Cotonou, Benin, was slightly damaged in a mid-air collision with a Senegalair Hawker Siddeley HS-125 96V-AIMO on a medevac flight, which as a result was lost off the coast of Senegal, during a flight from Ouagadougou, Burkina Faso, to Dakar. The 737 did not land at Cotonou, but flew to its intended ultimate destination at Malabo, an island off Cameroon.			
8 September	British Airways	Boeing 777 (G-VIIO)	Las Vegas airport, USA	-/1	13/157	TO
			Early in the take-off run, the aircraft suffered a catastrophic, uncontained failure of the left General Electric GE90-8B5B engine, apparently in the area of the high pressure compressor. This started a fierce fire beneath the left wing which had caused considerable damage by the time the airport fire crews were able to extinguish it although they attended very quickly. There were a few minor injuries to passengers during the evacuation, which took place on the runway.			
15 September	Qatar Airways	Boeing 777-300ER (A7-BAC)	Miami International airport, USA	-/-	?/?	TO
			The aircraft entered runway 09 for take-off at intersection T1, and shortly after rotated it hit the approach lights to the reciprocal runway, 27. The approach lights were subsequently notified out of action, and the aircraft received damage but flew to its destination at Doha, landing safely.			
8 October	Starbow	BAE Systems 146 (9G-SBB)	Tamale airport, Ghana	-/-	6/70	L
			The aircraft overran the end of the 2,440m runway 23, ran through a barrier and came to rest with the nose gear collapsed. It was good daylight visibility but there were rain showers in the area and the runway surface was wet.			
12 October	Tristar Air	Airbus A300F (SU-BMZ)	Nr Afgoye, Somalia	-	6	L
			The crew carried out a forced night landing in open farmland after several failed attempts to land at Mogadishu's Aden Adde airport left the aircraft with very little fuel. The aircraft was damaged beyond repair. Mogadishu airport has no functioning landing or approach lights and is thus closed at night, and after a delayed departure from Ostend, Belgium the A300 freighter arrived after dusk. There was no moon, and several attempts to land at the airport ended in go-arounds.			
16 October	Tigerair	Airbus A320 (9V-TRH)	Singapore Changi airport	-/-	6/167	TO
			The engine cowlings on the left engine opened and were ripped off as it climbed away from runway 02 at Changi. They struck the left undercarriage doors and severed a hydraulic line. The aircraft took up a holding pattern to assess the damage and burn off fuel, and then returned to land safely.			
29 October	Dynamic International Airways	Boeing 767-200ER (N251MY)	Ft Lauderdale, Florida, USA	-/1	11/90	G
			The crew of another aircraft notified the 767 crew that they appeared to have a bad fuel leak from the wing, near the left engine. The 767 crew requested a return to the gate, but a severe fire erupted around the left engine. The passengers evacuated and the fire was extinguished, but at least one passenger was reported badly burned. There appeared to have been a leak from the main fuel line in the engine pylon area.			
3 November	Shaheen Air International	Boeing 737 (AP-BJO)	Lahore International airport, Lahore, Pakistan	-/-	7/112	L
			On landing inbound from Karachi, the aircraft veered off the runway and both main gear legs collapsed. The landing took place in benign weather – and a passenger video appears to show a stable approach – but after landing, the aircraft began to shake violently. Local press reports suggest that one set of main gear tyres failed.			
6 November	Batik Air	Boeing 737 (PK-LBO)	Yogyakarta International airport, Java, Indonesia	-/-	5/161	L
			The aircraft, inbound from Jakarta, landed in heavy rain and overran the 2,200m runway 09, causing the nose gear to collapse.			
10 November	Westwind Aviation	BAe HS-748 (TL-AEW)	Malakal, South Sudan	-	4	TO
			The 49-year-old aircraft suffered some kind of problem on take-off and the crew carried out a forced landing ahead. The aircraft, on a ferry flight after having delivered a cargo of food for the UN world food programme, caught fire and was destroyed.			
13 November	Lao-Skyway	Xian MA60 (RDPL-34226)	Vientiane airport, Laos	-/-	?/?	L
			The aircraft, inbound on a daylight domestic flight from Luang Prabang in benign weather, suffered a runway excursion.			
22 November	Avia Traffic	Boeing 737-300 (EX-37005)	Osh airport, Kyrgyzstan	-/-	5/148	L
			Before this landing, the aircraft had diverted to Bishkek because the weather at Osh was below limits. When the weather was reported to have improved, the flight, originally scheduled from Krasnoyarsk to Osh, took off from Bishkek for its scheduled destination but, on landing at Osh, ran off the runway to the left, causing the left main gear to collapse and the No 1 engine to separate.			



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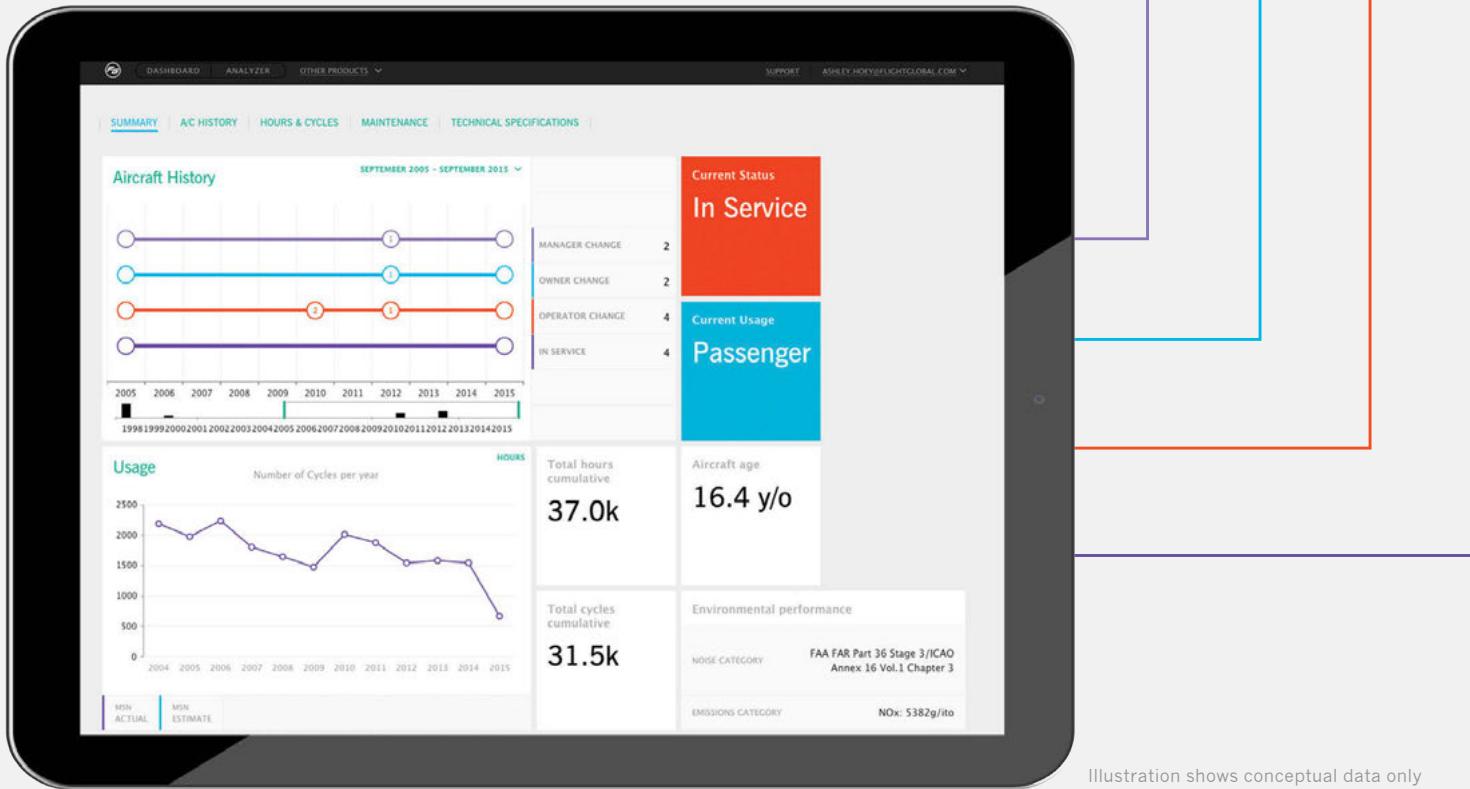


Illustration shows conceptual data only

From yuckspeak to tales of yore, send your offcuts to murdo.morrison@flightglobal.com

Cosying up to the press

Airbus moved its annual press conference to just off the Champs Élysées last week rather than its usual venue, the Toulouse delivery centre.

The rather compact seating arrangement – where hacks had to squeeze in next to each other with laptops perched precariously on trays and precious little elbow room – prompted comparisons with Airbus's advertisements poking fun at the width of its rival's economy seating.

"You'd never accept a press conference like this..." grumbled one reporter.

Off the money

Meanwhile, at the Paris event, the John Leahy Smugometer peaked at 11 as he quipped that his sales department would be taking the rest of the year off after notching up 1,036 net orders and boosting the backlog in 2015.

However, the dial returned to safer levels when the sales supremo admitted that his earlier prediction of 25 commitments for the A380 for the year had "cost me a lot of bonus" – there were just three, minus one cancellation.

Unstable tables

Mal Royston spotted this picture on Twitter of the Soyuz capsule being readied ahead of its



Congratulations to Tracey Curtis-Taylor, who has completed her solo trip from the UK to Sydney in her open-cockpit 1942 Boeing Stearman, Spirit of Artemis. She landed in the Australian city on 9 January, over three months after leaving the UK on 1 October – her 21,000km adventure inspired by Amy Johnson's solo flight on a similar route in 1930. She says she hopes her achievement will "inspire the next generation to follow their dreams".

mission to the International Space Station. As he notes: "Look more closely and it appears the whole spacecraft is supported by two rickety tables."

Baggage blunder

What caused Malaysia Airlines' sudden U-turn on its draconian baggage restrictions?

Just one day after Europe-bound economy passengers were limited to just a single 7kg item – and even first-class travellers only allowed two 7kg pieces of luggage – the policy was reversed. The restrictions

had stirred up a social media storm stronger than the unusual headwinds blamed for the new policy in the first place.

Surely the underling responsible for introducing the new rules had remembered to clear it first with chief executive Christoph Mueller?

Hot air

The debate over the UK's airport expansion can get heated.

In a recent Commons exchange, Labour MP Graham Stringer questioned why the honourable member for Richmond Park – London mayoral candidate and fierce Heathrow third runway opponent, Zac Goldsmith – was unable to be present for the transport secretary's statement on airport expansion.

Voice from the back benches: "His flight was delayed!"

Tingle bells

Late festive news: sadly, we missed the UK CAA's pre-Christmas appointment of a chap called Chris Tingle...



Floating in a most peculiar way?

Dirigible plans

It transpires the "giant dirigible," to be built for the U.S. Navy, is to be 175 feet long and 50 feet diameter. Work on it has

begun at the Navy yard, under the direction of Naval experts. It will be equipped with powerful engines and dynamos, and the armament will include a battery of quick-firers. It is stated it will carry a score or more of men, and is designed for long voyages.

Italian failure

Monday's (January 6th) communiqué from the Middle

75 YEARS AGO East spoke of increased activity by the Italian Air Force over eastern Libya. The usual result ensued. Seven Fiat CR42S and four Savoia-Marchetti S79s were destroyed and some others damaged.

Swiss air defence

Two British firms, Plessey Electronics and Ferranti, have a £2 million share of a Swiss contract for an air-defence system to be supplied by the Hughes Aircraft Co, the total value of which is reported to be £11 million.

Airbus uncertainty

A "turbulent and uncertain" year for Airbus Industrie is in prospect following the consortium's extraordinary success in 1990, when it won 404 firm orders, and increased its world market share to 35%. "We'll be lucky to make 100 orders this year," Airbus says.

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Cross-Channel counterparts Brian Trubshaw and André Turcat (right); and Turcat, pictured in 2009

Concorde's first pilot

After serving in combat with the French air force and honing his skills at EPNER, André Turcat became the nation's lead test pilot for Europe's iconic Concorde – first flown in March 1969

André Turcat's career spanned the glory years of French aerospace and, as one of two senior pilots in charge of the Concorde flight-test programme, he played a pivotal part in its most ambitious project.

Chief test pilot of what was then Sud Aviation, Turcat was the first person to fly Concorde, piloting the prototype from Toulouse on 2 March 1969 on a 27min flight. Along with his UK counterpart Brian Trubshaw, he helped steer the supersonic airliner to certification, retiring from Aérospatiale, aged 55, in the same year as Concorde entered service, 1976.

Born in 1921 in Marseille, Turcat began his aviation career in the air force, serving in the Indochina war and later training as a test pilot at the prestigious EPNER school. Leaving the military, he joined the state-owned Sud Aviation and his credentials as a test pilot made him the clear choice to fill that role on the new Concorde programme in 1964.

Writing exclusively for *Flight International* in 2003 – the year Concorde was retired – Turcat recalled the period running up to roll-out: "The Concorde prototype was assembled in an isolated hangar in Toulouse. Imprisoned like a dove in a net of scaffolding, gang-planks and ladders; we pilots looked down questioningly on the long body and the huge wings and wondered: would we really be able to make this creature fly? And then it was painted white, ready for show, even if missing some of its nerves and muscles."

He went on: "The big bosses arrived with ministers for the roll-out on 11 December 1967. It slowly appeared, freed for the first time from all its scaffolding. We all held our emotions in check, particularly Brian Trubshaw, my cross-Channel counterpart, and myself, thinking of the millions of hours we were going to have to undertake."

Turcat, who was always embarrassed by the attention

he received as the first Concorde pilot – believing this took the spotlight away from the thousands behind the scenes who played equally vital roles – was exceptionally proud of the aircraft and the team behind it, from senior management down. However, he acknowledged not everything went perfectly during the build-up to first flight.

SAFETY FIRST

"Sadly, the lack of thought and industrial organisation between the French and British aircraft manufacturers when the 1962 inter-governmental agreement was signed, in my view, lost us three years in getting the aircraft into operation," he wrote in 2003. He also admitted possible failings.

"I admit that in the name of safety, I did perhaps make too many demands, increasing certain costs," he said. "With hindsight, I'm not sure I was right. But everything went well and that was what we were responsible for, conscious an accident or serious incident would compromise the programme."

He went on: "Readers can imagine the professional worries and joys we had: participating in the conception of this edifice of systems; thinking about all possible failures to counter them in time; conceiving of each command, each control instrument; working in a space ever too small; requesting modifications from the simulator, in which we spent over 1,000 hours before the first flight."

After retirement, Turcat dabbled in politics, serving as deputy mayor of Toulouse and as an MEP. He strongly supported Concorde's return to service after the fatal crash near Paris Charles de Gaulle in 2000, when 113 people were killed. He died at his home in Aix-en-Provence in southern France on 4 January, aged 94. ■

André Turcat, 23 October 1921 – 4 January 2016



To access our historical coverage of the Concorde programme, visit flightglobal.com/archive

EVENTS

3-4 February

Aircraft Interiors Middle East
Dubai World Trade Centre, UAE
aime.aero/welcome-to-aime-2016

16-21 February

Singapore Air Show
Changi Exhibition Centre, Singapore
singaporeairshow.com

17-19 February

Routes Americas
Puerto Rico
routesonline.com/events/178/
routes-americas-2016

29 February

Loyalty 2016
Bangkok, Thailand
flightglobalevents.com/loyalty2016

1-3 March

Heli-Expo
Louisville, Kentucky, USA
helixpo.rotor.org

6-8 March

Routes Asia
Manila, Philippines
routesonline.com/events/180/
routes-asia-2016

8-9 March

Airline & Aerospace MRO & Operations IT Conference – Americas
Miami, USA
aircraft-commerce.com

15-17 March

IATA World Cargo Symposium
Berlin, Germany
iata.org/events/wcs/pages/index.aspx

22-23 March

Aerial Firefighting International
Sacramento, California, USA
tangentlink.com/event/aerial-
firefighting-international-2016

29 March - 3 April

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Santiago, Chile
fidae.cl/en

5-7 April

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Hamburg, Germany
aircraftinteriorsexpo.com

12-14 April

ABACE
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18-21 April

Defence Services Asia
Kuala Lumpur, Malaysia
dsaeexhibition.com

27-28 April

Aircraft eEnablement & IFE Conference
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aircraft-commerce.com

28 April

Loyalty@Freddies 2016
Las Vegas, USA
flightglobalevents.com/
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Xponential
New Orleans, USA
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For a full list of events see
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WORK EXPERIENCE ISOBEL HALL

Finding the best path for new pilots

After spotting that opportunities were becoming restricted for trainees following a modular route, Isobel Hall established Kura Aviation to give aspiring applicants a more cost-effective route into the airline industry

Tell us about your career so far.

I have worked in pilot training for the past 18 years; first for FlightSafety and then Oxford Aviation Academy (OAA), culminating in my role as 'global lead – selection and customer services' when CAE acquired OAA in 2012. During that time I spent three months running the Gondia training school in India, which was one of the best experiences of my life. I left OAA and worked as a consultant before setting up Kura in 2013. I have been very lucky; I've worked with modular and integrated self-sponsored cadets; airline cadets and international airlines and have been involved in setting up programmes such as the EasyJet multicrew pilot licence, British Airways future pilot programme and, most recently through Kura, the new first officer modular pathway with BA CityFlyer. It can be a changeable industry and I have experienced the highs and lows of all of it, shoulder to shoulder with students, colleagues and pilots. Would I work in any other industry? Absolutely not.

Why did you launch Kura?

I have worked with hundreds of fantastic pilots who have trained through both the integrated and modular training routes. I saw that there were fewer airline opportunities for modular trained pilots, while emphasis was growing on integrated career programmes offering professional development training and



Kura Aviation

"It is nothing short of a privilege to work with people so motivated"

employment support. I didn't believe this was good for individuals – or the industry – so I set up Kura to create new training and employment opportunities as a way for aspiring pilots to access the profession by the most cost-effective route possible in the knowledge that there was no compromise in training quality or employment opportunities. And, at the same time, I was giving airlines the same risk reduction strategies through our type rating performance guarantee. I'm really pleased that we have achieved all of this.

What are the challenges facing the pilot training industry?

The biggest challenge for aspiring pilots is the huge cost barrier; it is a huge risk to invest in training when there is no guaranteed airline job. For training organisa-

tions, the biggest challenge is to deliver training that creates outstanding first officer candidates who have the breadth and depth of knowledge, skills and attitude airlines require of flight crew.

Pilot training is a competitive business. How do you stay ahead of the game?

I believe Kura is unique: we are creating new airline employment opportunities; we have our own rigorous selection process, not based on first series passes or ATPL exam results, but airline potential; we provide constructive feedback regardless of whether or not applicants enter our training programme; we support modular and integrated students wherever they trained; and, finally, I am very proud of the fact we are now the first Community Interest Company

(CIC) in the sector. Being a CIC means our profits must be reinvested back into the pilot community and will be in the form of funding and sponsorship opportunities. We are independent and that is also very important.

What do you enjoy most about your role?

I have met the best people of my life working in aviation and I love the customers. It is nothing short of a privilege to work with people so motivated and so passionate – the risks and hard work they are prepared to undertake in order to achieve their dreams is unbelievable. The joy of seeing them get their first airline job is nothing short of amazing.

The least?

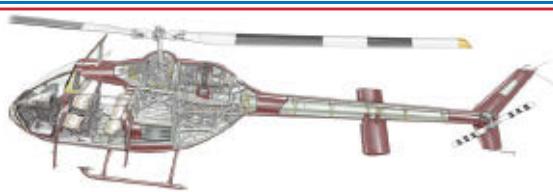
Keeping up with technology! But in terms of the industry, when there's a downturn it's really tough for pilots and those training. Fortunately it's a good time for aspiring pilots at the moment.

Where do you see yourself five years from now?

Still forging ahead with delivering industry-leading training and with Kura, generating lots of opportunities to help natural-born pilots into the profession. ■

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